WINNING FLIGHT TECHNIQUES

WORLD'S SMALLEST RADIAL

MODEL Airplane NEWS

50 WARBIRDS ALMOST READY TO FLY

page 28

Make easy fiberglass parts

WE FLY

P-51
quick-build warbird

Stagger Bee
sport-plane kit

Super Decathlon
giant aerobatic design

Glassair 400
glow-powered glider

Tiger Moth
easy-build backyard flyer

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SEPTEMBER 2001

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MODEL Airplane NEWS

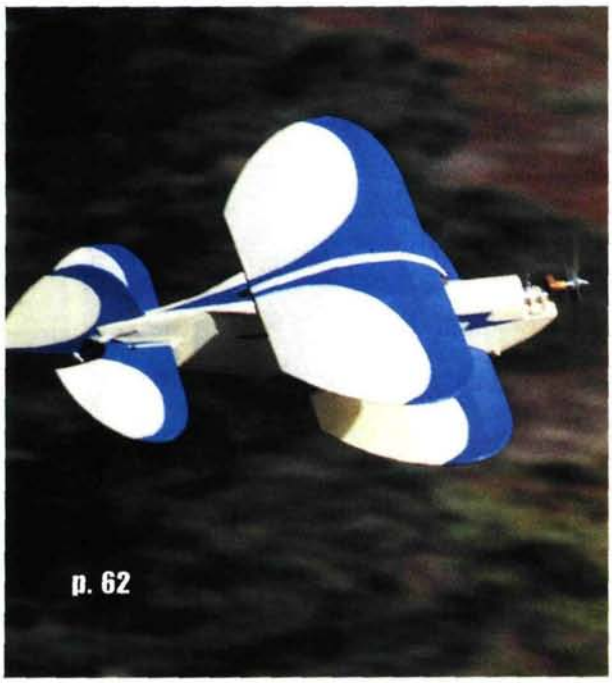
SEPTEMBER 2001 • VOLUME 129, NUMBER 9

ON THE COVER: *main image—the OK EZ P-51 Mustang from Altech is a highly detailed ARF with great flight performance; check out Craig Trachten's review on page 54. Inset: Dan Santich and his majestic ½-scale Formula One racer, Miss San Bernadino. Plans are available at the RCStore.com; see page 150 for details.*

Features

Construction

Field & Bench Reviews



Columns

Departments

EDITORIAL
BY DEBRA SHARP

Almost-ready-to-fly warbirds

Who among us hasn't dreamed of being an ace fighter pilot? The speed, drama and fierce looks of fighter aircraft easily inspire us all. Now, having your own dream warbird has never been easier. In this month's "Warbird Guide" on page 28, we've compiled information on more than 50 classic fighters, and the best part is that each high-quality model is almost ready to fly. Also included are tips on flying your warbird, personalizing it and competing with it in scale and racing events.

For those of you who are looking for a competitive edge in scale contests, George Leu offers tips on how to improve your flight score in his "Scale Techniques" column. A veteran scale judge himself, George shares exactly what judges look for and critique when they score your model's flight routine. Read his column and watch your flight scores soar.

Kyosho's detailed Spitfire is just one of the ARF warbirds featured on page 28.

MISS SAN BERNARDINO

If bigger is better, then Dan Santich's ½-scale Miss San Bernardino just may be the best plan we've ever offered. With a wingspan of 134 inches, this giant Formula One racer isn't for the faint of heart, but it's sure to turn heads wherever it flies. Dan piloted his model at this year's Joe Nall event and wowed the crowd with its aerobatic capabilities. In a separate how-to article, Dan details how he made the fiberglass wheel pants and cowl for Miss B.; use his proven technique to make custom parts for any size model.

ENGINE NEWS

On a smaller scale, this month's "Final Approach" features a miniature, functional 4-stroke. Created by George Luhrs, this 2½-inch-diameter engine runs on lantern fuel and was awarded first prize at this year's National Model Engineers Exposition.

Gerry Yarrish's review of the RCV 120-SP provides another look at an unconventional powerplant. Just how much torque does this rotating-cylinder-valve 4-stroke put out? See Gerry's findings on page 70.

WEST COAST ELECTRICS

At this year's San Diego Silent Electrics Fly-In, pilots showed off more than 350 RC aircraft. The popularity of electric power is skyrocketing, and models at this event ranged from large aerobats and scale planes to fun-fly foamies and tiny indoor models. *Model Airplane News* contributor Thayer Syme was present to capture the excitement and magnitude of this event; check out his coverage on page 36. For electrics enthusiasts, this is one fly-in you don't want to miss.

At the San Diego meet, Hitec's Funtec Sky Scooter was exceedingly fun and exciting for pilots and spectators alike. Pylon Racing, All Up/Last Down and Combat were the competitions of the day.

MODEL Airplane NEWS
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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we cannot respond to every one.

ENGINE TROUBLE ?

I recently built the Hangar 9 ARF PT-19 and installed a 4-stroke Saito 1.50. I took it to my local airfield and, because I'm not the world's most perfect flier, I let a more experienced pilot take it up for its first flight. It flew perfectly without needing any trim, but the engine bogged and gave me trouble in transition from idle to mid-throttle. Hangar 9 recommended that I install an onboard glow driver, and I did, but the engine did the same thing—even after I had set it up with a tachometer. Fear of having to cope with a dead-stick landing prevents me from flying the plane.

Do you think this problem is the result of the engine's always being inverted? What if I mounted it upright or sideways? To mount it upright, I'll have to lower it and the mount, thus changing the engine's chord line; will this adversely affect the plane's performance even if I don't change the firewall downthrust?

Could you give me some input on this? I'm ready to install a 2-stroke, but I really hate to do that because I think a 2-stroke would ruin the warbird's beautiful looks. [email]

JOE PISTILLI

First, Joe, don't listen to anyone who tells you that "Inverted is the problem"; 4-strokes don't care whether they are inverted or not, so don't think about remounting it. That's old 2-stroke thinking. Since they were introduced, I have mostly run 4-strokes, and in scale models, most were mounted inverted; that didn't cause a problem.

Because of the bogging from idle to mid-range you write of, here's my best guess. Which plug do you run? If it isn't an O.S. F plug, it should be. Throw out the plug that came with the engine, and install the O.S. F. There isn't a better plug for a 4-stroke—period. It will give you a noticeably better idle and throttle transition.

You don't say which fuel you use. In all my 4-strokes, I use Wildcat Premium Xtra (not Wildcat's 4-stroke fuel) with 15 percent nitro. Also, did you install the tank in a position other than that recommended? The tank's center line should be in line with or just slightly below the spraybar. I have used several Saito 1.20s, 1.50s and a 1.80, and they all ran beautifully inverted. Good luck, and let me know how you make out. CC

BUILDING A "BOX" FUSELAGE

I found Dave Robelen's terrific article on tissue covering for balsa models on your website [www.modelairplanenews.com] and printed it out.

Could you tell me the best way to make a "box" fuselage like the one on the model featured in that article? After I complete the sides, how do I ensure that the cross-members, when glued into place, will result in an aligned, square, proper configuration? Do I build a jig, work directly over the plan—use pins? Start in the middle, the nose, or the tail—or what? I'm trying to build a Lockheed Altair from an old plan; I messed up my first attempt and was so discouraged that I began to think of altering the plan to create a keel for the formers, but I'd prefer to master the art of making a box fuselage (I did it as a boy, many, many years ago). [email]

MARV SCHILLER

Glad you enjoyed what you found on our website. "Pokey"—the model Dave used to demonstrate his tissue techniques—will soon be featured in our sister publication, RC MicroFlight *(www.rcmicroflight.com). An excerpt from Dave's article should help you to build a box fuselage:*

"A nice, flat building board is a must; I use an old sheet of Plexiglas. Pokey is built using quite a few straight pins (I recommend the ones that are sold in fabric shops for pinning silk and other fine cloth). I have had good results building over plans that are protected with wax paper.

"Pokey's fuselage is about as basic as it gets: two side frames with some sheet fill joined with crosspieces and a little more sheet balsa. Assemble the sides (one at a time) over the plan, and when the glue has dried, sand the sides smooth. Install the cabin-area crosspieces first; glue them to one side and then to the other side. Work over the top view, and before going further, take as long as you need to get a square frame. When you're satisfied with your work, glue the tailpieces together and then add the nose crosspieces and follow them with the rest of the pieces. Fit and install the sheet fill material, and the fuselage is finished."

Hope this helps, Marv. When you've finished building your Lockheed Altair, please send a photo for "Pilot Projects." DS

CASTOR AND 4-STROKES

I always look forward to Chris Chianelli's "Air Power," but he has me confused about fuel for 4-strokes. He uses Wildcat Premium Xtra for its castor content. However, Wildcat recommends the use of all synthetic for these engines to avoid varnish buildup on the valves. Is this a real concern?

BOB LESTER
Olympia, WA

Bob, here's the deal with castor in 4-strokes: I believe in using a little in 4-stroke fuel. Because, unlike 2-strokes, 4-strokes don't breathe through the crankcase, you can't run the crankcase dry of unburned methanol. This alcohol that remains trapped in the 4-stroke's crankcase attracts moisture and causes premature corrosion on low-end parts such as main bearings—very bad! So far, I haven't found anything that guards against this better than a bit of castor in the mix—say, 3 to 5 percent of the entire oil mix, which, in Premium Xtra, happens to be 18 percent.

Years ago, castor of dubious quality found its way into fuel, and this was particularly bad on 4-strokes because their higher combustion temperatures led to quick varnishing. The better the castor, the less varnish it will leave. But the buzz was started that castor—any castor—wasn't good for 4-strokes. Not true. Though the oil shouldn't be exclusively castor, having some is very good, as it leaves a protective coating on internal parts. Wildcat uses very high-quality castor in its Premium Xtra fuel. Yes, Wildcat does make what it calls a 4-stroke fuel that doesn't contain castor and claims that it contains a corrosion-retardant agent that's as good as, or better than, castor. I haven't confirmed this yet but intend to run some tests; until then, I'll stick with castor. Call me old-fashioned. CC

AIR SCOOP

BY CHRIS CHIANELLI

New products or people behind the scenes: my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

O.S. ENGINES

Fuel-Injection 1.60 FX-CFI

If you've ever flown a model powered by a fuel-injection engine, you've probably been amazed at the improved performance; that's because a built-in computer monitors rpm, temperature and air/fuel mixture. The newest from the O.S. Engines line, the 1.60 FX-CFI promises 1,800 to 9,000 practical rpm and features the convenience, consistency and smooth transition that comes from computerized fuel injection. Say goodbye to finicky throttle and carburetor adjustments and get on with flying your latest giant! Retail price: $1,499. Specs: 1.323 inches bore; 1.165 inches stroke. Weight, 33 ounces; 34.6 ounces with E-5010 silencer.

O.S. Engines; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.osengines.com.

WATTAGE

Ezette—Complete RC Package

One box holds everything you need: this cute, high-wing, Speed-400 flyer, easy-to-use Hitec Focus 3 transmitter and two standard servos, a DC-input fast field charger and an airborne, 8-cell, 800mAh NiMH battery pack. The 42-inch-span Ezette features all-wood construction, a two-piece wing and a removable tail section—and it can be bolted together in minutes. It also comes with the motor, prop, WattAge Super 380 proportional speed control, rudder and elevator servos and linkages already installed. At a wing loading of 13½ ounces per square foot of wing area, the Ezette's performance should please both newcomers and more experienced fliers. The best part? Sources say that it will cost less than $250!

WattAge; distributed by Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.

GIANTSCALEPLANES.COM

Transall C-160

The latest from GiantScalePlanes.com, this scale, 72-inch-span ARF cargo plane is one of a kind. It comes with a fiberglass fuselage, a two-piece, sheeted foam wing ready for hinging, a gray fiberglass cowl and decals. It also features shaped and beveled leading edges and installed control-horn mounts, and the wing comes ready for aileron servo installation. Two .20 to .25 2-strokes or two .26 4-strokes are recommended. Cost is $349.99.

GiantScalePlanes.com, 201 S. 3rd St. & Rt. 309 N., Coopersburg, PA 18036; (610) 282-4811; fax (610) 282-4816; www.giantscaleplanes.com; hhi@fast.net.

KYOSHO

Two New Warbirds

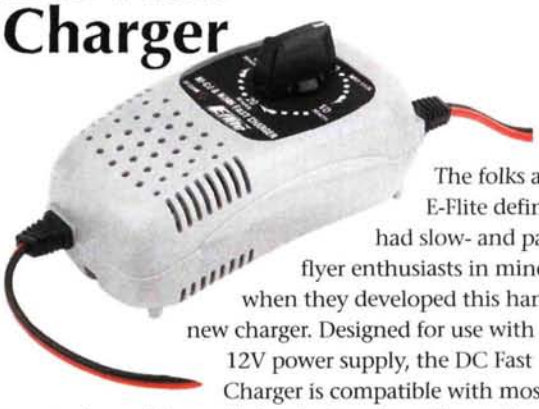
Kyosho proudly introduces two new additions to its classic line of quality fighters. The almost-ready-to-fly F-86F Sabre is a glow-powered jet that's remarkably easy, quick and affordable. Best of all, it comes equipped with an O.S. .15 CV ducted-fan engine that produces incredible speed. The kit includes a special manifold and muffler that help keep the engine running at the proper rpm. The Sabre is constructed of lightweight balsa and fiberglass with a silver gelcoating on the fuselage for a sleek, authentic look. With a wingspan of 39.4 inches, a weight of 3.3 to 3.7 pounds and length of 38 inches, the Sabre requires a 4-channel radio with 4 miniservos and sells for $579.99.

The Super Quality Series PT-17 Stearman ARF follows in the Kyosho tradition of attention to detail. It's constructed entirely of lightweight balsa and is covered in film that replicates the original trainer's blue and yellow trim scheme. The large wheels and landing gear are true to scale, and the Stearman comes with all the necessary hardware. It requires a .40 to .46 2-stroke or a .48 to .53 4-stroke with a 4-channel radio and five servos. It has a wingspan of 49.4 inches, a weight of 5.5 pounds, a length of 38.9 inches and is priced at $349.99.

Kyosho; distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

E-FLITE

DC Fast Charger



The folks at E-Flite definitely had slow- and park-flyer enthusiasts in mind when they developed this handy new charger. Designed for use with a 12V power supply, the DC Fast Charger is compatible with most battery packs used in small electric aircraft and is small enough to fit in your glove compartment. It will charge 6- to 7-cell Ni-Cd and NiMH packs ranging in capacity from 250 to 700mAh. The DC Fast Charger includes a 30-minute timer and alligator-clip connectors for only $14.95.

E-Flite; distributed by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9611; www.horizonhobby.com.

JETT ENGINEERING

Turbo-Jett In-Cowl Muffler

Because of this muffler's unique design, not only can it hide inside your model's cowl, but it can also increase your engine's horsepower by 25 percent (compared with stock mufflers). Perfect for many scale craft, as well as for sport aerobatic models, the Turbo-Jett muffler is available for most 2-stroke, side-exhaust glow engines of from .25 to 2ci displacement. Noise levels with the Turbo-Jett are comparable with those measured with a stock muffler.

Jett Engineering Inc., 6110 Milwee, Ste. J, Houston, TX 77092; (713) 680-8113; fax (713) 680-8164; www.jettengineering.com.

AERO-MODEL INC.

Park-Flyer Power

A new geared, brushless series of motor, the Hacker B20 is designed for small electric models and is available in long and short versions and with or without a 4:1 planetary gearbox. The geared motor is recommended for slow and park flyers, while the direct-drive motor is a better choice for pylon racers and other low-drag designs. The B20-18L motor shown here is especially suited for use with an 8-cell, 600mAh battery pack and a 10x6 APC prop.

Aero-Model Inc., 2122 W. 5th Pl., Tempe, AZ 85281; (480) 726-7519; fax (480) 963-5565; www.aero-model.com; aeromodel@uswest.net.

HANGAR 9

Ultra Stick 40

Nearly identical to its 1.20-size counterpart, the Ultra Stick 40 comes 90 percent assembled from top-quality balsa and ply and is covered with genuine Goldberg Ultracote. With its unique quad-flap design, the Ultra Stick 40 has outstanding short-field performance and is the perfect plane for anyone who wants to explore the world of aerobatics. Priced at only $129.95, the kit comes with hardware and includes a universal motor mount that will accommodate from .40 to .58 2-strokes and .50 to .74 4-strokes.

Hangar 9; distributed by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9611; www.horizonhobby.com.

LIKES LINE

Electric Retracts

Hank Likes has been making dependable, shock-absorbing, Oleo-strut retractable landing gear for a long time, and he has many designs and styles to choose from. Likes Line retracts are electrically driven and use a rugged jack screw to actuate the gear. They also have adjustable microswitches to set the up-and-down lock positions. Two new gear sets are available; both are made from 6061 T-6 aircraft-grade aluminum. The larger unit shown is designed for 1/5- to 1/4-scale 25- to 55-pound SBD Dauntless Dive Bomber aircraft; the other is for typical 1/5-scale 15- to 35-pound fighter aircraft. Both have a transit time of about 7 seconds—perfect for scale speed. Each unit's strut angle is adjustable from 80 to 110 degrees.

Each unit comes with a complete power system, including a battery pack, charger, switch harness and color-coded wiring for easy installation. No field support equipment is required, as the gear can cycle many times on a single battery charge.

Likes Line, 1601 Airport Dr., Mechanicsburg, PA 17055; (717) 732-0636; www.aero-sports.com/likesline.

NORVEL AND SIG MFG.

Distribution Agreement

Sig Mfg., which recently celebrated a half century in the modeling industry, has teamed up with Norvel, a relatively new company that has taken the small-engine world by storm. Sig will provide exclusive U.S. distribution and marketing of Norvel engines and parts as well as its Glassair and Neofun lines of ARF RC airplanes. For modelers, it's the best of both worlds: readily available Norvel engines, parts and planes from Sig, while Norvel has more time to design engines and other RC goodies.

Sig Mfg. Co. Inc., 401-7 S. Front St., Montezuma, IA 50171; orders (800) 247-5008; (641) 623-5154; fax (641) 623-3922; www.sigmfg.com; mail@sigmfg.com.

READERS' TIPS & TRICKS

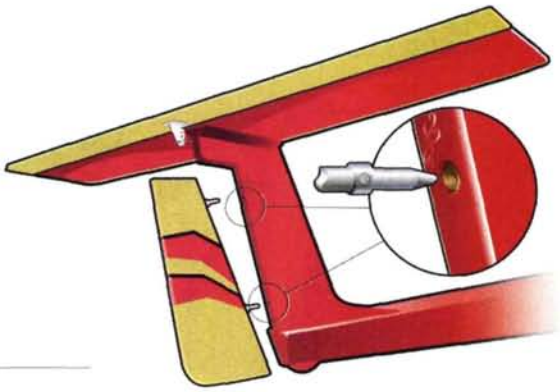
WITH ILLUSTRATIONS BY DAVID BAKER

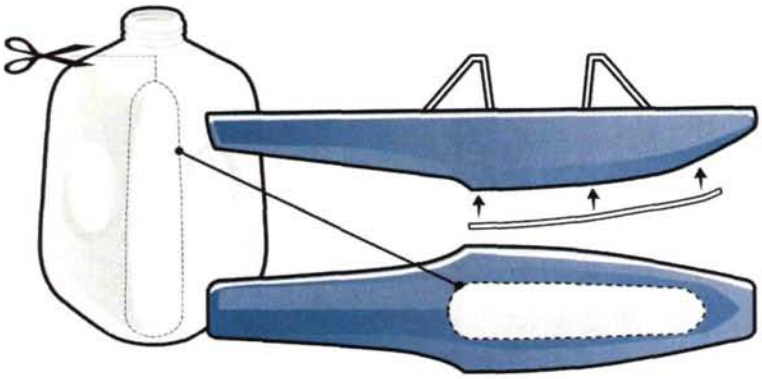
SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Readers' Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

FINDING AND SEALING HINGE SLOTS

After you have covered a model with either a fabric or a film covering, it is often difficult to find the hinge slots and then cut open the covering around them. Sealing the covering down around the opening is also difficult. A good way to do both of these things at one time is to use a fine-tipped soldering iron to melt through the covering, which also seals it to the wood surrounding the hinge slots. This technique also works when you want to seal around switch openings and other holes in your model.

Vernon Olson, Kane, PA





MILK-JUG PROTECTION

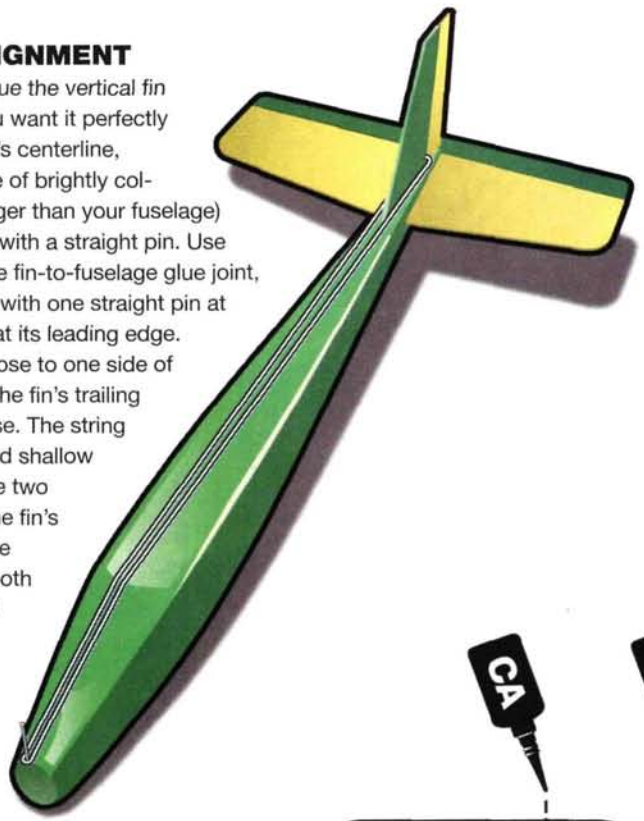
You'll be able to safely beach your seaplane if you protect the bottoms of the pontoons with plastic strips cut from an empty plastic milk jug. Cut the corners from a gallon jug and glue them into place, as shown, with a waterproof glue such as Zap-a-dap-a-Goo.

Charles Weigel, Pulaski, NY

PERFECT FIN ALIGNMENT

When you are ready to glue the vertical fin onto your model, and you want it perfectly aligned with the fuselage's centerline, use string! Fasten a piece of brightly colored string (2½ times longer than your fuselage) to the center of the nose with a straight pin. Use slow-setting epoxy for the fin-to-fuselage glue joint, and pin the fin into place with one straight pin at its trailing edge and one at its leading edge. Run the string from the nose to one side of the fin, and then around the fin's trailing edge and back to the nose. The string now forms a very long and shallow V with the fin between the two lengths of string. Move the fin's LE back and forth until the string lays flush against both its sides, and then the fin will be perfectly aligned. Add a few more pins to secure the fin in place and let the epoxy cure.

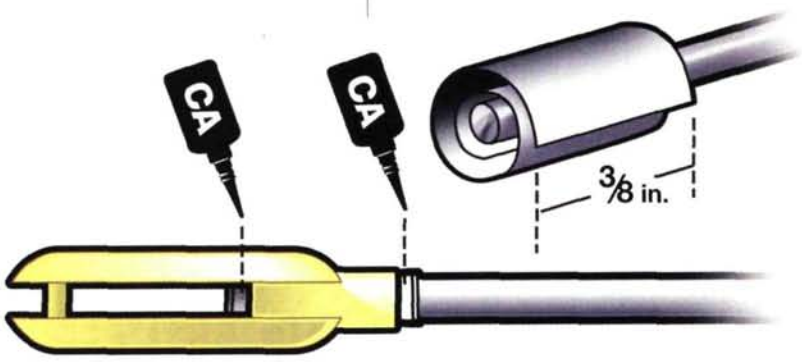
Ron Fikes, Palo Alto, CA

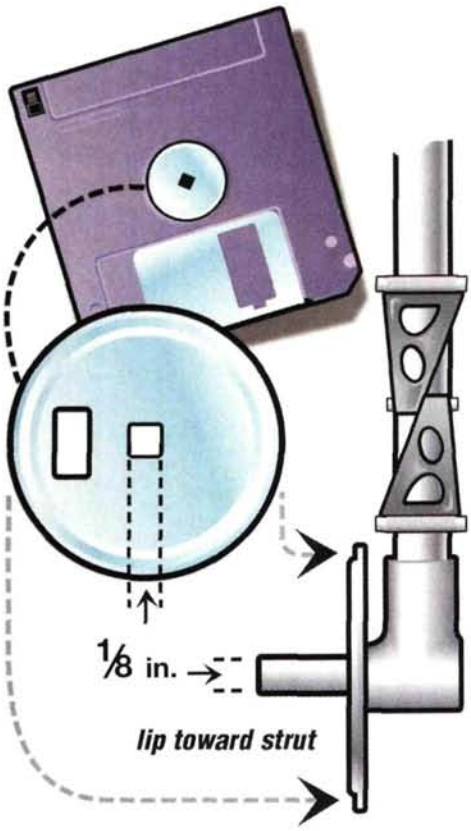


LIGHTWEIGHT CONTROL RODS

If you want an ultra-lightweight control rod for an indoor or park-flyer model, try this. Run a 2-56 tap through a small nylon clevis and then wrap a ⅜-inch-wide strip of tissue paper around the end of a thin carbon-fiber rod until it is just thick enough to fit into the hole in the clevis. Put a few drops of thin CA on both ends of the paper where it sticks out from the clevis, and the adhesive will wick into the clevis and bond it securely in place. You can adjust the pushrod's length by adding a threaded-brass coupler to the servo end of the rod; wrap tissue paper around the rod until it fits snugly into the coupler and then add the CA.

Sam Golden, Speedway, IN

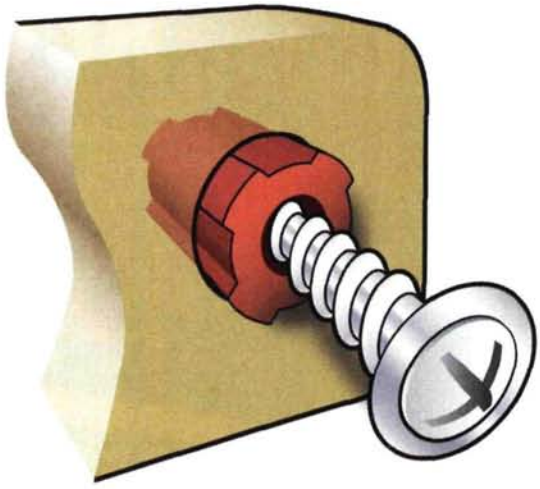




FLOPPY DISC BRAKES

Realistic-looking aircraft-brakes' backing plates can be easily made by taking apart an old 3.5-inch floppy disc. Pry apart the plastic covering and remove the floppy disc. At the disc's center is a metal drive plate that is perfect for the job. Drill the small square opening in its center to the size of your axle, and slip it into place between the wheel and the strut; then glue it into place. You don't even have to paint it silver!

Scott Eaton, San Leandro, CA



EASY INSERTS

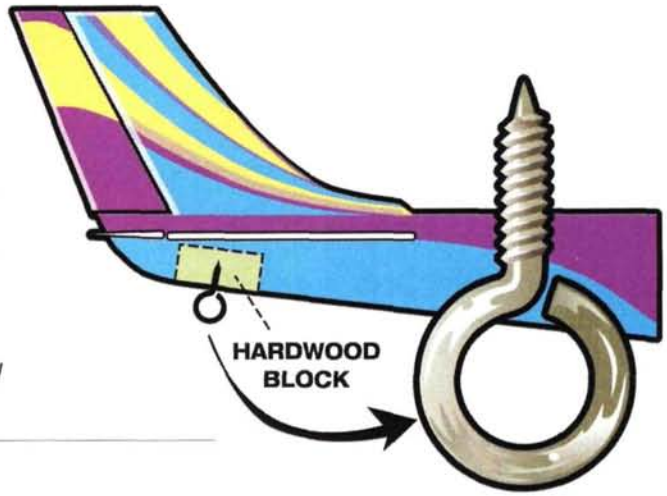
Holes in the wood blocks that support engine-cowl-attachment screws are often stripped out or slit. By drilling a hole in the block and then inserting and gluing a short length of inner Nyrod into it, you can make snug-fitting inserts that accept the cowl-attachment screws. Should an insert strip out, you can easily replace it with a new one.

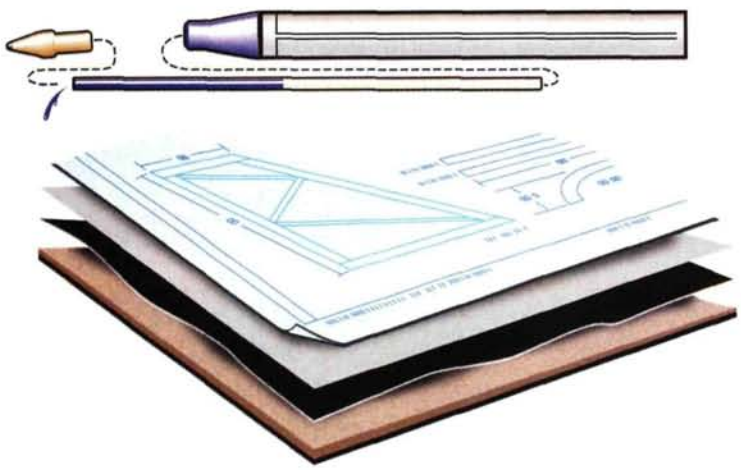
James McCoul, Sterling Hts., MI

EYEHOOK TAILSKID

It is often difficult to find very small tailwheels for small electric- and ½A-powered models. A good substitute is to screw a small metal eyehook into the bottom of the model's fuselage just in front of the rudder. Since it's round, it looks like a tailwheel and since it's made of metal, it lasts forever—even if you fly off pavement. For a more scale look, dip the eyehook into epoxy and when the adhesive has set, paint it black so it looks more like a rubber tire.

Frank Harper Jr., Eaton, OH





PERMANENT PAPER SCRIBER

If you build from a plan, one of the easiest ways to duplicate parts without cutting up the plan is to put carbon paper under the plan and then trace the outline of the part directly onto the wood. This scratch-builder takes an ink tube out of a ballpoint pen, and he replaces it after he has removed the ink with water or alcohol. After scribbling on scrap paper to remove the very last bit of ink, he's left with a roller-ball-tipped scriber. Use the scriber as a tracing tool to transfer the outlines of the plan parts. It's a lot neater than using a pen; an ink-covered plan tends to smudge when you build your model.

Ward Kelly, Sidell, LA

PILOT PROJECTS

A look at what our readers are doing

CLASSIC RACER

Don Harris of Bandon, OR, sent us this photo of his Jeep, which he built from a set of Wendell Hostetler plans. Don modeled his plane after the one flown by Art Chester in the 1936 Los Angeles National Air Races, and the result is truly authentic. The model is powered by an ST 4500, and it weighs in at 22 pounds with an 84-inch wingspan. It's covered with Coverite and MonoKote and finished with vinyl graphics.

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so send in a photo or two with a brief description!

Send those pictures to: **Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.**

OUTBACK WARBIRD

This JU-87B-2 comes to us all the way from Kingsgrove, Australia, where Don Murray took a 1/24-scale Heller plastic kit and scaled it up to create this amazing Stuka dive-bomber. Don's model is powered by an O.S. .91 FSR with a Futaba radio. It weighs 14 pounds, has a 72-inch wingspan and features functional, oil-damped oleo struts, flaps, dive brakes, a bomb release and landing and navigation lights. Don has flown his model more than 70 times and says that it's an easy model to fly.

OUT OF THIS WORLD

Jerry Heuertz of Lincoln, NE, is the proud owner of this 1/3-scale Sig Spacewalker. It's Jerry's first giant-scale project, and he's quite pleased with the result. The Spacewalker has a 104-inch wingspan, weighs 20 pounds and is powered by a Zenoah G-38 swinging an APC 18x10 prop. It is controlled by a Futaba 6-channel computer radio with two heavy-duty JR switches and two batteries. Jerry covered his plane with Sig Koverall, airbrushed on some Sig dope and finished it with an automotive clear coat. He completed the scale appearance with 1/16-inch pinstriping.

COLORFUL CAT

Tom Jackson of Eureka, CA, sent us this photo of his F8F Bearcat, which he built from an American Eagle kit. Tom's plane runs on a Zenoah G-62 engine and a Futaba UAF radio with eight servos. Its wings span 86 inches, and the model weighs in at 33 pounds. The beautiful finish was achieved with PPG base coat, clear coat and automotive paint. The Bearcat has flown about 20 flights and, according to Tom, still flies great!

PACIFIC JUG

By increasing the wingspan 5½ inches and adding a ventral fin, Joseph Scalet of Chesapeake, VA, converted this Top Flite giant-scale P-47 to the N variant used in the closing months of the War in the Pacific theater. Joseph's plane is powered by a 4.2ci engine and features flaps, bomb and centerline fuel-tank drops, a Top Flite scale cockpit and dummy radial, Century Jet retracts, a Robart tailwheel, an Aerotech pilot, weapons pylons and bombs. It weighs 21 pounds and is finished with Ultracote and Perfect Paint.

◄ SLOPE-SOARING SAMURAI

This plane started as a Pica kit intended for use with a .25 engine, but Brian Koester of Los Angeles, CA, took a different route. He converted it to a slope sailplane by using Compufoil to design a new wing with a high-lift airfoil. The Zero's new wing is an all-balsa combination of Eppler 203 at the root and RG-15 at the tip. It's finished with an airbrush of Benjamin Moore exterior latex paint. This was Brian's first attempt at this type of conversion, but he's extremely happy with the result. He writes, "It flies fast and rolls like a BD-5."

TSAWWASSEN TOMCAT ►

This Great Planes F-14 Tomcat is only the fourth model ever built by Dale Wilfur of Tsawwassen, B.C., Canada, and he seems to be well on his way to becoming a master modeler. Dale's plane is powered by an O.S. FX .91. It uses a JR 652 radio with six servos and features air retracts and an Ultracote finish. Pictured with the plane is Dale's 3½-year-old son, Tyson, who, according to Dale, knows almost as much about RC flying as Dad does.

TEXAS ANGEL

Check out this Top Flite AT-6 Texan finished with the Blue Angels' color scheme to resemble an actual Navy SNJ. The photo was sent to us by John Soule of Austin, TX, who was given the completed 65-inch, 7½-pound scale beauty as a Christmas present by his wife, Patty and Jim Vier, his friend and the model's builder. John's model

is equipped with a SuperTigre 90 engine and a Futaba T6XA computer radio. It features Century Jet retracts and split flaps. The plane can be found soaring above the flying field at Mary Moore Searight Park in South Austin, where John and Bill are members of the Hill Country Aeromodelers RC Club.

WHO LET THE DOG OUT?

This photo of a ¼-scale Cessna L-19 Bird Dog comes to us from Wayne Fussell of Palm City, FL. Wayne scratch-built his plane from a set of Vailly Aviation plans and he powers it with a Zenoah G-62 with working scale exhaust. Wayne's Bird Dog weighs 26 pounds, has a wingspan of 108 inches and is controlled by a Futaba radio. The model is covered with orange and white MonoKote and features functional doors and windows. According to Wayne, this model is a joy to fly, and with 50-percent flaps deployed, it lands like a trainer.

Almost Ready to Fly Warbird

50 classic fighters

An old saying among fighter pilots goes, "There are only two kinds of airplanes—fighters and targets!" Among modelers, there's no denying the popularity of the former—especially WW II fighters. Aircraft such as the P-51 Mustang, F4U Corsair and Supermarine Spitfire are superstar icons of the battles fought over Europe and in the Pacific theater. It is probably safe to say that modelers everywhere have, at one time or another, looked forward to flying a warbird. With the popularity of almost-ready-to-fly (ARF) models at an all-time high and with so many well-built ARF warbirds to choose from, there has never been a better time to treat yourself to that fighter than right now!

To complement the high-performance fighters described in this guide, we

Guide


Kyosho Bf 109E

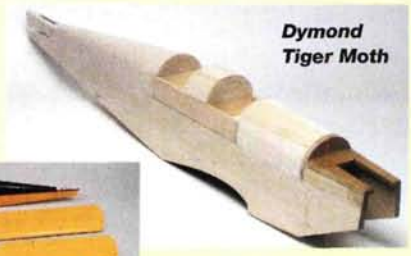
by the staff of Model Airplane News

include details on popular military trainer aircraft from the 1950s and earlier. There are squadrons of aircraft to pick from; regardless of which insignia you want on the wings, there's sure to be something here for you. You, too, can fly a warbird!

Built to last

ARFs are constructed of three basic materials: wood, fiberglass and laminated foam/plastic. Each has its assets and drawbacks, but all of the ARF kits described in this guide are well engineered and go together relatively easily. Here are a few facts to think about when you decide which type of kit to buy.

Wood—very commonly used for ARF warbird kits that require only minor assembly of prebuilt parts that often arrive covered with heat-shrink plastic film. Wings are usually supplied in halves for shipping, but several of the newer models come with one-piece wings. Wooden ARFs are relatively easy to repair, and the repaired areas can be covered with new film covering.


Dymond Tiger Moth

Fiberglass—used for parts such as engine cowls, belly pans and wingtips and even for the entire fuselage. Fiberglass kits are very light and save you time and effort because they are often already painted and have decals applied. Strengthening plywood bulkheads are factory-installed in the fuselage at key stress points. During rough landings or other mishaps, paint can crack away from the fiberglass as it flexes under stress. Repair major damage with an internal patch of fiberglass cloth and epoxy resin or even thin CA. When cutting a painted fiberglass cowl to accommodate the engine, be careful not to chip the paint; if you do chip it, you might be able to apply thin CA around the opening, sand the area smooth and touch it up with matching fuelproof paint.


21st Century F4U Corsair

Laminated foam and Mylar plastic—often referred to as "EZ" construction, this is very light and strong and has been used for many years in ARF construction. Surface details and markings are frequently printed right on the material, which is then coated with a clear protective finish at the factory. Details such as panel lines, rivets and fuel caps make models look more like the real thing without any effort on your part. Vacuum-formed plastic parts—engine cowl, top fuselage turtle deck, wingtips, stabilizer and fin tips and belly pans, for example—help give these models their finishing touches. Though the material looks very attractive, the laminated foam that covers the strong underlying wooden structure can be difficult to repair. Don't use a CA glue to mend breaks unless you know you have one that is foam-friendly. Thirty-minute epoxy and lite-ply internal patches work well to fix broken parts.


MRC/Altech EZ P-51D Mustang

When it's time to patch your fighter, consider the materials it's made of. All but the most severe damage can be repaired, and your fighter will live to fly another day.

40-SIZE WARBIRD ARF GUIDE

Manufacturer	Model	Engine(s) 2-stroke	Engine(s) 4-stroke	Span (in.)	Length (in.)	Min. flying wt. (lb.)	Wing loading (oz./sq. ft.)	No. of channe
21st Century	AT-6 Texan	.40 to .50	.48 to .70	57	40.75	5	23.09	4 to 5
	F4U Corsair	.40 to .50	.48 to .70	55	42	5	23.75	4
	P-47N Thunderbolt	.40 to .50	.48 to .70	55	45	5	21.86	4 to 5
3 Sea Bees	Focke Wulf FW44	.60 to .75	.80 to .90	72	58.4	11.31	11.5	4
AMD	PT-19 Fairchild	.40 to .52	—	60.5	39	4.625	14.88	4
	PT-20 Ryan	.40 to .52	—	64	45	5.5	18.97	4
Dymond	Tiger Moth	.40 to .56	.52 to .61	50	42	5.5	16.25	4
GiantScalePlanes.com	P-40E Warhawk	.40	.52	55	43	5.5	24.77	4 to 5
	P-47 Thunderbolt	.40	.52	55.5	44	5.5	25.76	4 to 5
	P-51 Mustang	.60	.91 to 1.20	68	61	8.5	23.97	6
	PT-20 Ryan	.40	.52	64	41	5.5	19.8	4
Global	F4U Corsair	.46 to .60	.52 to .65	53	41	5	23.04	4
	P-47D	.40 to .53	.80 to .91	56	44	6.75	28.8	4 to 5
	PT-19 Fairchild	.40 to .53	.52 to .61	56	42.5	5.4	24.88	4
Great Planes	AT-6 Texan	.40 to .51	.48 to .80	59.75	42.1	5.6	23.14	4
	DH Tiger Moth	.61	.91	71	55	10.25	17.36	4 to 5
	F4U Corsair	.45 to .52	.70 to .80	55.75	45.75	8.3	31.66	4 to 5
	Ju-87 Stuka	.61 to .75	.91	70	55	8	23.94	4 to 7
	P-51D Mustang	.40 to .50	.60 to .80	57	51	6.75	26.81	4 to 5
	Spitfire	.40 to .51	.60 to .70	54	45.25	6	25.13	4 to 5
Hobby People	Yak-18	.36 to .46	.40 to .52	54.5	42.5	4.5	22.54	4
Kangke USA	T34 /60	.61 to .90	.91 to 1.20	65	54	8	27.03	4
Kyosho	AT-6 Texan	.40 to .46	.48 to .53	61.5	44.5	5.7	22.88	4
	Curtiss P-40 Warhawk	.40 to .46	.52	56	46.5	6	26.23	4
	DH82 Tiger Moth	.40 to .46	.48 to .53	54	44	6.2	15.89	4
	F4U Corsair	.40 to .46	.48 to .53	58	44.7	6.2	24.9	4
	Messerschmitt BF109E	.40 to .46	.48 to .53	56	47.6	5.7	24.92	4
	Mitsubishi Zero	.40 to .46	.45 to .60	54	44.5	5.7	25.67	4
	PT-19 Fairchild	.32 to .40	.48 to .53	61.7	47.6	6	24.38	4
	Spitfire	.40 to .46	.50	56.7	46	5.7	23.79	4
Lanier RC	P-51 Sport	.45 to .60	.60 to .91	63	45	6	21.94	4
Model Tech	P-51 Mustang	.40 to .46	.52 to .61	57	44	5.25	20.5	4 to 5
MRC/Altech	EZ P-51D Mustang	.40 to .50	.70 to .72	54.7	46.4	5.75	24.9	5
	EZ Zero 45	.40 to .50	.70 to .72	55.6	46.1	5.75	24.58	5
The World Models	F4U Corsair	.46	.70	55	47	6.5	26.09	5
	P-39 Airacobra	.60	.91	62.5	51.5	7.5	24.3	4
	P-40 Warhawk	.40 to .46	.70	58.5	50	7	25.89	5
	P-51 Mustang	.40 to .46	.70	57.5	49.5	6	23.63	5
	P-82 Twin Mustang	Two .32 to .40	Two .40	70.5	49	9.5	29.74	6
	PT-26 Fairchild	.36 to .40	.52 to .70	57.5	44	5.5	23.77	5
	Zero 60	.60	.91	60	45.5	7.5	27.21	5
VMAR	AT-6 Texan	.40 to .53	.52 to .70	62	44	5.5	20.44	4
	Bombardier Harvard II	.46 to .60	.50 to .80	57.75	49	5.5	23.47	4
	DH Beaver 40	.46 to .60	.50 to .80	71.25	43	6	18.94	4
	DH Beaver 60-90	.60 to .90	—	81	55	6.75	15	4 to 5
	P-51D Mustang	.40 to .53	.52 to .70	60	48	6	23.83	4
	RAF Chipmunk	.40 to .53	.52 to .70	62.5	42	5.5	22.63	4
	RCAF Harvard	.40 to .53	.52 to .70	62	44	5.5	20.44	4
	Spitfire	.46 to .60	.50 to .80	60.75	44	6.43	24.01	4
	T34 Mentor 40	.40 to .53	.52 to .70	63	42	5.5	22.63	4
	T6A Texan II	.46 to .60	.50 to .80	57.75	49	5.5	23.47	4
	F4U Corsair	.60 to .76	—	63.75	47	7.5	27	4
	Pilatus	.45 to .61	.50 to .80	57.75	49	5.5	23.47	4

FG = Fiberglass

Price	Features
$169.99	Balsa-sheeted foam const.; built-up wings; includes hardware, gear, wheels, decals
$199.99	Balsa, ply and FG const. with built-up wings; includes hardware, gear, wheels, decals
$194.99	Balsa-sheeted foam const.; built-up wings; includes hardware, gear, wheels, decals
$849.00	All wood; covered in German or Swedish color scheme; includes hardware, scale flying wires; museum-quality detail available
$150.00	Gelcoated FG fuse and cowl; balsa wing; painted; includes hardware and decals
$150.00	Gelcoated FG fuse and cowl; balsa wing; painted; includes hardware, decals
$189.99	Balsa and ply const. with aluminum struts; Oracover; includes hardware
$199.00	Gelcoated FG fuse, balsa-sheeted foam wings; polyester film covering; includes hardware and decals; retracts optional
$199.99	Gelcoated FG fuse, balsa-sheeted foam wings; polyester film covering; includes hardware and decals; retracts optional
$279.99	Gelcoated FG fuse, balsa-sheeted foam wings; polyester film covering; includes hardware and decals; retracts optional
$199.99	Gelcoated FG fuse, balsa-sheeted foam wings; polyester film covering; includes retracts, hardware, decals
$219.99	Balsa const.; covered in polyester film; includes hardware
$199.99	Wood const.; Ultracote covered; includes hardware and decals
$230.00	Balsa const. w/foam-core wing; covered in polyester film; hardware
$154.99	Wood const.; MonoKote covered; includes hardware and fixed gear
$299.99	Wood const.; MonoKote covered; hardware installed; includes gear
$199.99	Wood const.; poly-foam composite covering w/trim; includes hardware and fixed gear; will accept rotating retracts
$299.99	Sheeted all-wood const.; Coverite flat covering; optional flaps; hardware installed; includes gear
$199.99	Wood const.; poly-foam composite covering w/trim; includes hardware and fixed gear; will accept retracts
$147.95	All-wood const.; poly-foam base cover with color camouflage; includes hardware and decals
$124.99	Wood fuse const. with foam wing; iron-on covering
$247.77	Balsa const. w/FG fuse; Oracover covering; includes hardware and decals
$249.99	Gelcoated FG fuse, balsa-sheeted foam wing; includes hardware and fixed gear; retracts opt.; includes decals
$219.99	Balsa const.; covered in heat-shrink film w/camouflage pattern; includes hardware, fixed gear and decals
$249.99	Balsa const.; cloth-processed film covering; includes hardware and landing gear
$279.99	Gelcoated FG fuse and wing center section; includes hardware, decals, fixed gear; retracts optional.
$199.99	Balsa const.; matte finish camouflage cover with markings; includes hardware and fixed gear
$229.99	Gelcoated FG fuse, sheeted foam wing; includes hardware, fixed gear and decals
$229.99	Balsa const.; covered in heat-shrink film with scale colors; includes hardware
$169.99	Balsa const.; covered (camouflage trim); includes hardware
$79.99	Finished ABS plastic fuse; Aero Sheet covered foam-core wing; includes hardware and prebent gear wire
$229.99	All-wood const.; covered; includes both retracts and fixed gear, complete hardware
$340.00	Laser-cut wood frame, multi-laminate skin with full markings and details, includes retracts, hardware and decals
$320.00	Laser-cut wood frame, multi-laminate skin with full markings and details, includes retracts, hardware and decals
$249.99	FG fuse with one-piece rib-wing; includes retracts; includes hardware and decals
$249.99	Balsa/ply const.; covered; includes hardware and decals
$249.99	Balsa/ply const.; hand-painted camouflage; includes hardware and decals
$189.99	Balsa const.; iron-on covering; preinstalled retracts; includes hardware and decals
$329.99	Balsa const.; iron-on covering; preinstalled retracts and split flap; includes hardware and decals
$169.99	Balsa/ply const.; iron-on covering; includes hardware and decals
$249.99	Wood const. with FG fuse; iron-on covering; includes hardware and 4 sets of decals
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$199.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$139.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware; RCAF color scheme also available
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$146.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware
$149.95	All wood const.; covered in heat-shrink film w/details; decals not required; includes hardware; three color schemes available

Global F4U Corsair

GiantScalePlanes.com P-47 Thunderbolt

Great Planes AT-6 Texan

Kyosho F4U Corsair

MRC/Altech EZ Zero 45

The World Models P-82 Twin Mustang

VMAR P-51D Mustang

Tail-dragger checkout. Use right rudder!

Most fighters are tail-draggers with a conventional main gear and a steerable tailwheel. It's a good idea to get some stick time with a tail-dragger before you attempt to fly a warbird. This is especially true if you want to build and fly one that is equipped with retracts. You need to know something about the following:

Engine torque. This is the enemy of every tail-dragger; it tries to swing the aircraft to the left when you apply throttle for takeoff. As the prop spins clockwise (as viewed from the cockpit), torque tries to rotate (roll) the fuselage counterclockwise. This increases the load on the left main landing gear and decreases it on the right. Right rudder is required to prevent the model from rotating to the left. Torque is easier to deal with if you advance the throttle gradually and smoothly, and its effects disappear once the airplane is in the air.

Kyosho Spitfire

Gyroscopic progression. This force tries to make the airplane swerve to the left when the tail rises during the takeoff roll. At the start of the takeoff run, the thrust force is basically the same throughout the prop-disk area. When the tail comes up, the top of the prop moves forward. Because the prop spins clockwise, the forward force at the top of it is transferred 90 degrees to the right. This right-side push on the prop forces the model's nose to the left. Again, right rudder is needed to correct the heading.

P-factor. This force attempts to veer the airplane to the left after takeoff. "P-factor" refers to the asymmetrical (unbalanced) thrust produced by the prop while the airplane is at a high angle of attack. The thrust imbalance is produced because, in the climb attitude, the prop's pitch relative to the airflow is higher on the right side as one tip travels downward than it is on the left side as the other tip travels upward. Hold a little right rudder during the climb-out to maintain a straight heading. Once the model has leveled out and is no longer climbing, P-factor is no longer a concern.

It's more important to know what to expect and what to do than to over-analyze the causes. In all the cases just described, just use right rudder to correct heading.

Center of gravity (CG). Keeping a tail-dragger on a straight course during takeoff and landing is very important because its CG is behind the main gear. This means that the tail-dragger is less stable than a tricycle-gear plane in which the CG is in front of the main gear. If you let the tail drift too far left or right, the model might ground-loop, and this will increase the side loads on the main gear. If you have retracts, they might fold, and you could damage your model or break the prop. Maintain rudder control until the model stops rolling.

Taming a tail-dragger is not really all that difficult to do. As always, all it takes is practice and an understanding of the forces involved.

Toolbox do's and don'ts

Before you become a world-famous RC warbird pilot, you have to assemble your fighter. Though these kits are almost ready to fly, a certain amount of assembly and setup work is left to you.

Here are a few tips to help you get to the airfield in short order. Remember the basics, and you'll be successful!

Do read all the directions before you begin to glue parts together. They usually have to be joined in a specific order if the kit is to go together properly.

Don't use 5-minute epoxy. It may be good for fast field repairs, but it doesn't give you enough time to correctly align parts before it cures. Use 30-minute epoxy; it will allow you to correct your mistakes before it's too late.

Do have all required equipment and hardware on hand before you begin to build: engine, fuel system (if not included with the kit), radio gear and retracts (if called for). You might have to install some hardware before you can go to the following step, and having all the necessary items ready will save you time.

Don't rush; take your time, and if you can't figure something out, ask an experienced builder for help. It's easier to do it right the first time than to correct a mistake later on.

Do use the correct tools. Use the proper screwdriver for the job. If you have to tighten a nut, use a wrench of the correct size—not pliers that can slip and damage the part. Use sharp hobby knives (always dispose of dull blades safely).

Don't forget that this is supposed to be fun! If you get frustrated, stop what you're doing and take a break! Get a cup of Joe or head for the USO club and relax awhile. Don't take shortcuts when building any airplane.

Do find a wingman! It's always more fun to fly with a friend. Remember that the best part of being an RC fighter pilot is chatting with the other pilots about how well you can fly your warbird.

Hobby People Yak-18

Get in on the action

If you want a little more adventure than is available at your local warbird fun fly, turn up the heat up a notch by entering a fun-scale competition. Several such events are held every year, and they're the perfect places to start. More flying events than scale ones, the static portion is very simple: you have only to show some kind of documentation to earn the 5 points available. This may be a 3-view drawing, a picture cut out of a magazine, or even a hand-drawn picture. If you provide the documentation, you earn the full 5 points. Without it, you'll still be allowed to fly, but you'll lose 5 easy points!

From here, the event is the same as other scale meets. You specify your maneuvers on the flight-score sheet (some are mandatory) and are then judged as you fly them. Your static score and your average flight score are combined to determine your overall standing. The atmosphere is comparatively relaxed and less hectic than at a regular AMA scale meet.

Who knows? You might discover that you really enjoy scale flying. Then you can build a more detailed warbird and go after the big guns (well, after a while!).

Aircraft Markings

Ever since WW I, military pilots have taken artistic liberties by personalizing their fighters: colorful nose art, family crests, the pilot's nickname and the names of loved ones have all brightened these rather drab machines. The desire to personalize the things we value most seems to be a facet of our natures.

With very little effort, you, too, can make your ARF fighter distinctively yours by adding commercially available vinyl graphics. Several companies produce them—both water-slide and stick-on—and the variety of markings seems endless. Add a name with the rub-on letters you'll find in office-supply stores or you can have graphics custom-made. You'll find everything from very simple panel lines and rivets to entire aircraft packages displaying the insignia of any nationality you want; there is something for everyone.

Decal sources

Aero FX, Rte. 1, Box 225, Stratford, OK 74872; (405) 759-3333; www.aerotx.com.

Aeroloft Design, 130 W. Hampton, Ste. 20, Mesa, AZ 85210; (602) 649-8662; www.aeroloft.com.

CFC Graphics, 41 Blackmore St., East Greenwich, RI 02818; (401) 885-8002; www.cfcgraphics.com.

Kirby Kustom Graphics, 903 Settlemire Rd., Lebanon, OH 45036; (513) 932-2422; fax (513) 932-2422; www.angelfire.com/ohz/kirbysgraphics.

Major Decals/Northeast Screen Graphics, P.O. Box 304, East Longmeadow, MA 01028; (800) 557-5617; (413) 525-4110; www.majordecals.com.

Model Graphics, 312 Martin Oaks, Lafayette, LA 70501; (337) 269-5177; www.model-graphics.com.

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World Miniature Warbird Association

So you have a brand-new, shoot-'em-up warbird and you're tired of dogfighting with all the local Ugly Stiks and other slow-moving targets. What are you to do? Well, you can go to an all-warbird fly-in and check out what the other military-minded modelers are up to. Attending such events is a great way to make friends and further enjoy your warbird.

The World Miniature Warbird Association (WMWA) is dedicated to building and flying RC models of the world's combat and defense aircraft. There isn't any size restriction, and all military aircraft models are welcome.

Each year, the WMWA holds the Scale Warbird Classic Fly for its members. This year, they met at Crosswind Acres Airport, Drums, PA. The organization has about 60 wings across the U.S. and abroad. To find out whether there's a wing near you, check out the WMWA site at www.aero-sports.com/warbirds, or contact Dino DiGiorgio, P.O. Box 175, Succasunna, NJ 07876; (973) 584-6096; DinoD999@aol.com.

Let's go racing

Warbirds can be used for racing, too. The Scale Warbird Racing Association (SWRA)—an AMA group—is dedicated to those who enjoy the competition of unlimited "Reno" racers. Its members are interested in developing and improving scale warbird racing. The group organizes pylon racing for sport-scale RC models of reciprocating-engine military and unlimited racing aircraft.

SWRA racecourses are designed to be suitable for most RC fields; the models fly counterclockwise around two pylons in front of the pilots and parallel with the runway. A variety of classes allows newcomers and experts to compete at their particular level of skill.

Basic rules

Eligible aircraft: scale models of heavier-than-air, military fixed-wing, piloted aircraft that were in production after January 1, 1937, and non-military aircraft that have raced in the Unlimited class at the Reno or Mojave Air Races.

Minimum displacements
—single-engine aircraft: 30ci for 2-strokes; .40ci for 4-strokes.
—multi-engine aircraft: minimum combined displacements: .50 (2-stroke); .80 (4-stroke).

Maximum displacements
—single-engine: 1.20 (2-stroke); 2.40 (4-stroke).
—combined multi-engine displacements: 1.80 (2-strokes); 3.60 (4-strokes).

Maximum engine size is determined by an engine-size/wing-area formula that shows the minimum wing area allowed for engines of specific sizes.

Documentation: required to prove the model's fidelity to scale; must include one sheet for "Outline" and one for "Color, Finish and Markings." A maximum of 100 static points may be earned in three categories: accuracy of outline (40 points), color, finish and markings (30) and craftsmanship (30).

Racing heats consist of 10 laps, and the winners of each heat earn the same number of points as there are airplanes in the heat. In a four-plane heat, first place earns 4 points, second earns 3, and so on.

Pilots' flight points are totaled and then multiplied by an appropriate overall standings multiplier to determine their racing scores. These are then added to their static scores to arrive at the totals.

For more information on the Scale Warbird Racing Association, write to SWRA, P.O. Box 5622, Mesa, AZ 85211-5622.

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WEST COAST ELECT EXT

Steve Paulie built this Crackle from a plan in the January 1998 issue of Model Airplane News. *Modified to accommodate landing gear, it is powered by an Astro Cobalt 05.*

Here's a 36-inch-span Herr Engineering Cub by Chuck Haverlah. This model features full-house control and a functional bungee suspension. It's powered by a DM20G 4:1 motor, 8, 270mAh NiMH batteries and a VL 7½-inch prop. The covering is Litespan and Balsaloc.

This 42-inch-span ARF Wilga, imported by Hobby Club, flew well (and often) throughout the weekend. Power is from a geared Speed 400 on 7 or 8, 500 to 800mAh cells.

Steve Neu does some last-minute prerace tuning of his modified Funtec Sky Scooter. Steve's smooth flying—and a Hacker B40L 11-turn motor with 7, 800mAh cells—pulled this airplane to first place in the Modified class.

Steve Toschi's MiG 15s were frequently seen streaking across the field. For those who feel the need for speed, kits are available from RnR and K&A Models.

RICS
RAVAGANZA

The Silent Electric Fliers of San Diego host a first-class meet

by Thayer Syme

Modelers fortunate enough to make the trek to San Diego in February were richly rewarded with a four-day weekend of world-class electric flying. The fourth annual Mid Winter Electric Fly-In hosted by the Silent Electric Fliers of San Diego (SEFSD) and primarily sponsored by Hitec RCD was a rousing success, with more than 100 pilots registered. Estimates of the final model count rose to over 350 by the end of the event. The word is out: this event is a *must* for any electrics enthusiast.

Below: this 48-inch-span Fokker Eindecker E-III was scratch-built from Wylam drawings. It's powered by an Astro Cobalt 05G, 7, 2000mAh Sanyo cells and a 10x6 Top Flite prop. All controls are rigged with scale pull/pull cables. It weighs 60 ounces. Bottom: Hitec's new Funtec Sky Scooter was exceedingly fun and exciting for pilots and spectators alike. Pylon Racing, All Up/Last Down and Combat were the competitions of the day.

Top: this Simprop Sukhoi ARF belongs to Ward Shelley of Tracy, CA. It was extremely aerobatic with an Acro Drive 350 and 8, 600AE cells. Above: Ed Sweeney's Murray Laser conversion is powered by a pair of Aveox motors and a 3-blade, digitally controlled, constant-speed propeller that he developed. This power setup will provide up to 4.4hp at full throttle!

The flying started a bit slowly; recent rains had flooded the SEFSD field and forced the club to move the event to nearby Fiesta Island. On Friday morning, dedicated volunteers literally built a new runway by hand and then rolled it smooth with their cars. Their efforts were successful, and the first flights began less than two hours after the scheduled start on a new dry field.

Friday's flying was spectacular. The sky was cloudless, and the winds were light. Open sport flying was the rule, and the pilots were not slow to capitalize on the weather and the new facility.

On Saturday, unofficial flights began just after sunrise. Official flying followed the pilots' briefing shortly after 8 a.m. and didn't let up all day. The weather cooperated again with light winds under a high overcast. All types of activities filled the day, from laughter-inducing hijinks to serious competition. Beautiful scale models were put through their paces, helicopters danced, and racers streaked across the sky.

SKY SCOOTER SHENANIGANS

The folks who brought Funtec Sky Scooters had some of the most fun; there were three official events for these durable craft. The first was Sky Scooter pylon racing. Wise enough to know that no pilot can leave well enough alone, the event organizers offered both Stock and Custom classes. Both heats provided good racing action for beginners as well as experts. In the Custom class, veteran competitor Steve Neu ran away from the field with his all-red "Death from Below" model. His sense of humor really shone with this model that, despite being liberally covered with homemade decals—some of them flapping in the breeze—easily lapped the field. Perhaps it was a combination of his smooth flying and an Aveox motor that provided the winning edge. The planned Sky Scooter combat was an action-packed furball, as more than 15 aircraft tried to engage one another. Not a single hit was scored, but despite this (or perhaps because of it), the pilots and spectators nearly collapsed in laughter.

All Up/Last Down for the Sky Scooters was another interesting event. Some climbed aggressively, banking all hope on a long glide back to earth. Others thought it was a continuation of the combat event and tried to knock competitors from the sky. In the end, Hitec rep Glenn Merritt bested the field with an absolutely stock setup. His secret? He trimmed his model so it just slightly gained altitude in a large left circle and then set his transmitter on the ground!

RACERS AND SCALE MODELS

In more serious competition, Speed 400 pylon racing continues to advance. Despite their humble beginnings, these little $10 motors are generating amazing speeds. Their small airframes made these little screamers difficult to follow. Not to be outdone, the larger FAI-class racers provided another level of excitement as they made the smaller Speed 400 racers look just a bit more humble.

Do you have the need for speed with a larger wingspan? F5B gliders are astounding. With the ability to disappear from sight within a few seconds, these models are not for the faint of heart. Several of them took to the skies over the weekend.

Scale fans were not disappointed in the search for speed, either. Steve Toschi's remarkable MiG 15s were back, as were a number of their offspring: both RnR and K&A Models offer kits derived from Steve's handiwork, and these were well represented. These

Top: Chuck Haverlah's scratch-built U-2 with a Nikko fan and 8, 270mAh cells flew numerous surveillance missions with its onboard digital camera. The 1/24-scale plane has a 51-inch wingspan and was built mostly of cardboard. Above: Steve Clasen's Kyosho ARF CAP 232 in knife-edge flight. Powered by an Aveox F16LMR, 17, 2000mAh Sanyos and a 14x8 prop, it was fully aerobatic and was often seen intentionally snap-rolling on takeoff. Steve set a very high standard for electric aerobatics at this event.

Below: this is a Sig Kadet LT-25 by Gary Westland; it's powered by an Astro FAI 25 and 12, 2000mAh cells. It has a Master Airscrew 12x8E wood prop, and it weighs 5½ pounds. Bottom: streaking down the runway is this L-39 Albatros kit belonging to Ken Williams of K&A Models.

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fantastic airplanes gave a really convincing impression of jet-fighter performance.

Scale modelers who were looking for something a bit more relaxed, both in performance and cost, showed off a number of nice WW I and Golden Age aircraft. Fred Harris of San Diego brought a Nieuport biplane, a Sopwith Triplane, a Longster Wimpy and an American Eaglet Parasol. All were exceptionally well executed, and Fred flew them in a very convincing manner. Of more recent vintage was Chuck Haverlah's semi-scale U-2 driven by a small ducted fan. His 7-ounce model was complete with a small digital surveillance camera!

Perhaps the most impressive scale model was brought by Ed Sweeney of Black Forest, CO. Ed's model was a large Laser from the Murray kit. As impressive as the 66-inch-span airframe was in its own right, the power system was truly at the leading edge of model flying: two Aveox motors drive a 3-blade prop through a custom toothed belt drive. At full throttle, the power level is approximately 4.4hp! Obviously, you don't get to run that much power for very long with batteries, so Ed has gone several steps further toward refining the system. He spent much of the last year designing and prototyping the world's first digitally controlled, constant-speed propeller for model airplanes. His first flight ever with this system was Friday evening in waning light. Those of us who were still around were treated to something very special indeed. The story of this propeller is much too complex for this article. Suffice it to say that the power system seemed to fly his model quite well, and the sound at run-up as Ed cycled the propeller was just like that of a full-scale prop getting the same exercise. We all look forward to further development of this unique system.

Behind the active flightline, vendors bustled around selling some of their latest goodies. They also all generously donated products to the raffle. The raffle sponsors (see list) represented a true cross-section of the companies that are involved with electric flight. If you had a free moment to munch on something, there was a well-stocked food-service truck on the field throughout the weekend that sold very tasty wares. Few folks seemed to miss a convenient lunch between flights.

INDOOR FLYING

The explosion in popularity of smaller and lighter models prompted the addition of two indoor flying sessions this year. A nearby Confederate Air Force hangar was emptied for our use for five hours on Friday and Sunday. There were many familiar designs, such as Dan Kreigh's IFOs and the Hobby Lobby Blériot. These production models were complemented by several outstanding original models. These scratch-built flyers ranged from Chuck Haverlah's second U-2, this time with a propeller, to a 1.4-ounce, carbon-frame biplane by Greg Holmes. The creativity and enthusiasm exhibited by the producers of these small models were really infectious. I look forward to seeing the new crop of indoor models next year.

During the weekend, I overheard someone say that the Mid Winter Electric Fly-In may have become the premier West Coast electrics event. With four years of tremendous success and growth behind them, the Silent Electric Fliers of San Diego are showing every likelihood of this being so.

If you can make it to their 2002 fly-in, by all means do so. You will not be disappointed at this wonderful respite from the winter cold that grips most of the country. For more information, check out the Silent Electric Fliers' website at www.sefsd.org. ✈

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

Easy to build, fun to fly, giant-scale aerobat

by Rick Bell

DYNAFLITE

Super Decathlon

Dynaflite is well known for producing fun-scale, IMAA-size aircraft kits that are easy to build and fly great. The Super Decathlon is no exception; in fact, it's probably Dynaflite's best effort to date.

This sharp-looking, 89-inch aerobatic trainer has all the attributes sought by the first-time giant-scale builder; it's easy to build, has great visual appeal, and like its full-scale counterparts, it has wonderful flight performance. The two-piece wing is a welcome feature that provides convenient transportation and storage. In short, this plane has everything that a first-timer could ask for in a giant-scale aerobatic trainer.

SPECIFICATIONS

Model: Super Decathlon

Manufacturer: Dynaflite

Distributed by: Great Planes Model Distributors

Type: giant-scale, sport-scale kit

Wingspan: 89 in.

Wing area: 1,237 sq. in.

Weight: 16 lb., 4 oz.

Wing loading: 31 oz./sq. ft.

Radio req'd: 4-channel with 6 servos (5 high-torque)

Radio used: Futaba 9Z w/Futaba 9202 servos

Engine req'd: 1.08 to 1.80 2-stroke, 1.20 to 1.60 4-stroke, or 25 to 35cc gas

Engine used: Saito 1.80

Prop used: APC 16x8

Street price: $159.99

Features: all-wood construction, die-cut parts, two-piece wing, heavy-duty aluminum landing gear, three-piece ABS cowl, ABS wheel pants, formed windshield and illustrated instruction manual.

Comments: the Dynaflite Super Decathlon is an easy, quick-to-build, giant-scale model that flies well and looks great. Parts fit was excellent, and the manual provides lots of information. If you like to build and be the center of attention at your field, there is no better way to ease into giant scale!

Hits

- Easy to build.
- Excellent instruction manual.
- Wide variety of engine options.
- Wonderful flight characteristics.

Misses

- Wingtips require carving.
- Starburst patterns must be cut or copied from plan.
- No decals included.

THE KIT

The Decathlon comes in a smaller box than most large planes. It is well packed and includes lots of balsa, hardware, a three-piece ABS cowl, ABS wheel pants, a windscreen, one-piece aluminum landing gear, a rolled plan and a detailed, easy-to-understand instruction manual. The edges of the die-cut wood are sharp and cleanly cut.

The manual includes an inventory of kit contents and a list of items needed to complete the plan. It also has a building-notes section and patterns of the die-cut sheets. The plan comes rolled, and you must cut and tape two sheets together to make the fuselage. The windshield on my kit was warped, but a call to Great Planes put a new one in my hands within a couple of days.

CONSTRUCTION

Begin with the tail feathers; they are constructed of balsa sticks and fit together easily. The elevator tips and trailing edges (TEs) are laminated from five strips of 1/16x24-inch balsa. Old-timers will remember this type of construction; it produces a strong, light frame.

I placed pins where the instructions indicated, wet a balsa strip and pulled it around the pins to form the tip and TE. I then wet the other strips and glued them in place on the first strip using aliphatic resin instead of the recommended medium CA; it makes them easier to sand later. When the glue dried, I lifted the structures from the plan, rounded the leading edges (LEs) and TEs, added the hinges and installed the hard points for the tail bracing.

PHOTOS BY RICK BELL, WALTER SIDAS AND GERRY YARRISH

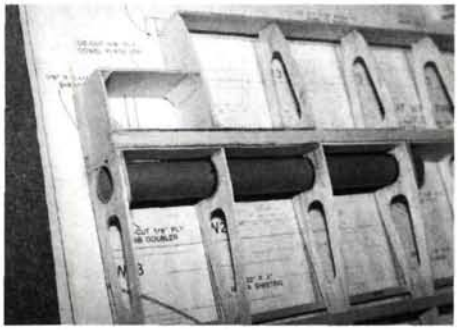
I mounted a Saito 1.80 for power. It made a respectable 9,200rpm turning an APC 16x8 prop.

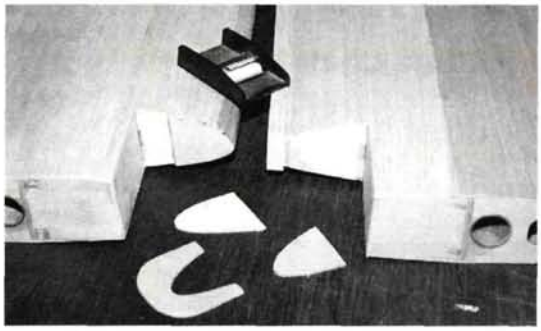
• **Wing.** Construction is easy and straightforward, but because of its two-piece design, the lite-ply rib reinforcement subassemblies for the aluminum wing tube and the basswood main spars must be completed before actual wing construction begins. The airfoil is semisymmetrical, so be sure that the top and bottom of the ribs are correctly oriented. I also jumped ahead and joined the sheeting before I started the wing.

First, I pinned a spar in place and used a ¼x⅜x42-inch balsa wing jig to set the correct amount of washout. Next, I added the ribs, the top spar, shear webs, remaining spars, the wing tube and the sub-LE. I then shaped the sub-LE to the rib contour and framed up the aileron bay. Last, I added the wing top sheeting and the capstrips where the directions indicated.

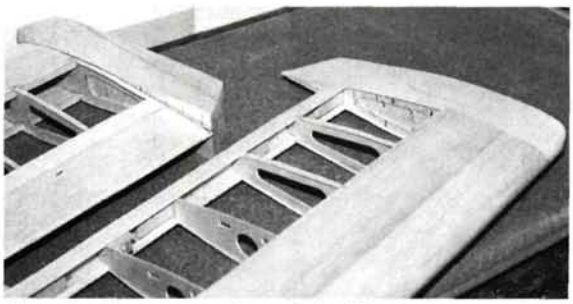
At this point, you can remove the wing panel from the plan, flip it over and realign it on the plan; make sure to properly place it over the wing jig to preserve the washout. Add the wing-strut-attachment blocks and the wing-mounting-bolt blocks, taper the TE sheeting, and sheet the bottom of the wing. After you have built the other wing panel, glue the LEs in place and shape them using the provided gauge to complete the airfoil.

The wingtips are made from large balsa blocks that need to be carved and sanded to shape. (I'd like to see Dynaflite use vacuum-formed parts here to save the builder a lot of carving, sanding and construction time.) After the tips have been completed, build the ailerons, hinge them to the wing, and fit the servos and pushrods.





Left: because of the wing's two-piece design, the rib reinforcement subassemblies for the aluminum wing tube must be completed before the actual wing construction begins. The remainder of the wing construction is fairly simple and straightforward. Right: the LEs are glued in place and shaped to complete the airfoil using the gauge shown in the foreground.



The wing tips come as large balsa blocks that must be carved and sanded to shape. Note the wing's semisymmetrical airfoil.

• **Fuselage.** The first step is to build the firewall. You can use many engines in the Decathlon, so the instructions show two firewall assemblies, depending on whether you select a gas or glow engine.

After you've built the firewall, build the three main bulkheads using balsa sticks and assemble the fuselage sides directly over the plan. True up the fuselage sides and place them on the fuselage top view. Install the bulkheads and firewall, then join the fuselage at the rear according to the instructions. Using the plan is a good idea because it helps keep the fuselage straight during assembly. The rest of the assembly goes along quickly without any problems.

To give the fuselage a little more shape, I added ¼-inch-square balsa strips to the longerons on the side of the fuselage from the rear to the cabin windows. This eliminated the flatness on the fuselage's aft portion. I then fit the wing panels to the fuselage, squared them up, and drilled and tapped the holes for the wing-mounting bolts. I installed the fuel tank, added the

FLIGHT PERFORMANCE

Because the big Saito 1.80 was new, I ran a few tanks of fuel through it to break it in. It made a respectable 9,200rpm turning an APC 16x8 prop. So after final systems and range checks, I was ready to go!

• TAKEOFF AND LANDING

Taxi tests were as expected for a large tail-dragger—responsive and well mannered. I throttled up the big Saito, and the Decathlon was airborne and climbing away after a surprisingly short takeoff run. This was going to be fun! A few clicks of down-trim produced straight and level flight. I had so much fun flying the Decathlon that I ran out of fuel; I ran the tank dry and had to make a dead-stick landing—not the ideal way to end the first flight! I'm glad to say the Decathlon glides well; I was able to make it back to the runway with no problems. The model lands like a pussycat and slows down to a walk. It's easy to grease 'em in with this one!

• GENERAL FLIGHT PERFORMANCE

With that big 89-inch wing, the Decathlon behaves well at low speeds, and control response is good. Forcing the Decathlon into a stall just makes it mush forward and nose down. No trim changes were needed from low to high speed. Simply apply some power and the model quickly gets flying again. Slow presentation passes down the runway are impressive and fun to do.

• AEROBATICS

Like its full-scale counterpart, the Decathlon is a great aerobatic trainer. The model handles any maneuver its big brother can do; loops tracked well and were as pretty as could be; rolls were easy from either direction. Four-point rolls were surprisingly easy, and knife-edge flight is also possible. What a great model to get into giant scale with!

forward bulkheads, and sheeted the front deck with 3/32-inch sheeting. Finally, I flipped the fuselage over to complete the built-up bottom. While the angles on the fuselage bottom look challenging, they actually go together very easily.

Next, add the tail feathers and true them to the wing. The instructions call for you to epoxy them in place at this point, but to make the covering job easier, I waited until after I had covered the plane. Because I wanted to use the starburst scheme, I'm glad that I went this route.

I then mounted the rudder and elevator servos to the middle of the rear fuselage, as indicated. Access to the servos is via a hatch that is screwed to the fuselage's bottom. I made up all of the control rods (you have your choice of materials) and hooked them up to the rudder and elevators. Be sure to use powerful, high-torque servos.

Next, make the wing struts and fit them to the airframe along with the windshield, which fit very well. Because I'm not a big fan of plastic cowls and wheel pants, I ordered a fiberglass set from Stan's Fiber Tech. The heavy-duty ABS plastic parts provided in the kit should hold up well for builders who stick with the stock units. I attached the cowl, made the appropriate openings and fitted and installed the wheel pants. Then the Decathlon was ready for final sanding and covering.

Here, the fuselage is nearly complete. The alignment tabs on several formers ease fuselage assembly by allowing you to evenly join the fuselage sides with minimal effort.

FINAL ASSEMBLY

I disassembled the airframe, gave it a final sanding to remove any humps and bumps, then covered the Decathlon with Coverite's 21st Century painted fabric to achieve the look of the full-scale plane. I also used its matching paint for the cowl and wheel pants. There are many paint schemes for the Decathlon, but I liked the starburst scheme pictured on the box best. While it looks complicated, it's fairly simple when broken down to basic components.

Dynaflite provides the patterns for the starburst, but you need to cut up or copy the plan to use the pattern. It would have been nice if Dynaflite had provided a separate sheet with the patterns, and I'd like to see decals provided for the "N" numbers.

Covering the Decathlon went well; the 21st Century painted fabric is great to work with, and I was amazed how easily it went on, especially around curves. The result was nothing short of spectacular.

After the covering was completed, I reassembled the model, epoxied the stabilizer and fin in place and added the tail bracing (Sullivan part no. S546), radio equipment and engine. For that final touch, I added a polished 2 7/8 Ultimate spinner from Tru-Turn. When I balanced the model, the CG worked out right in the middle of the recommended range—a first for me!

I set up the control throws as recommended, did a final check of everything, and the Decathlon was ready for its first flight.

CONCLUSION

The Dynaflite Super Decathlon is an outstanding IMAA-legal model that goes together easily and quickly. It looks fantastic, and its wonderful flight characteristics mean that pilots can learn giant-scale aerobatics without scaring themselves. Its all-wood construction is more akin to a sport 40-size model, and its two-piece wing makes it easy to transport and store. Want to be a big hit at the field? Show up with the Dynaflite Super Decathlon!

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Dynaflite; *distributed by Great Planes.*

Futaba Corp. of America; *distributed by Great Planes; www.futaba-rc.com.*

Great Planes Model Distributors Co., *P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.*

Stan's Fiber Tech, *2575 Jackson St., Riverside, CA 92503; (909) 352-4758; www.stansonline.com.*

Sullivan Products, *One North Haven St., Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443; www.sullivanproducts.com.*

Tru-Turn; *distributed by Romco Mfg., P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630; www.tru-turn.com.*

21st Century Fabric; *distributed by Great Planes.*

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

NORVEL GlassAir 400

A high-quality glider for glow or electric power

by Craig Trachten

Norvel's GlassAir 400 is a great new entry in the fast-growing world of park flyers. It is a high-quality, powered sailplane that is a perfect size for the local football field. My wife jogs on the track around the field while I'm on the 50-yard line exercising my thumbs. A really nice feature of the GlassAir 400 is that it can be built for either glow or electric power; the instructions for both are provided with the model, so you don't have to figure out conversions. As its name suggests, this model's fuselage is fiberglass, and it comes with semi-transparent metallic covering on the wing and tail surfaces. The kit also includes hardware for both power options. I had been wanting to try Norvel's BigMig .061 anyway, so that's the powerplant I chose.

SPECIFICATIONS

Model: GlassAir 400 ARF

Manufacturer: Norvel

Type: RC motor glider

Length: 35.4 in.

Wingspan: 72.8 in.

Wing area: 455 sq. in.

Weight: 22 oz.

Wing loading: 7 oz./sq. ft.

Power req'd: 6V Speed 400 with 4:1 gears (electric); .049 to .061 (glow)

Engine used: Norvel BigMig .061

Prop: Master Airscrew 6x4

Radio req'd: 3-channel

Radio used: Futaba 8UAFs with FMA Quantum sub micro receiver and 3 FMA servos

List price: $99

Features: 90 percent prebuilt; fiberglass fuselage; red or blue metallic wing and empennage; complete hardware package.

Comments: the GlassAir 400 is a great little aircraft that lets you fly in areas that might otherwise be too tight for an aircraft of this speed. It goes from the box to the air in about 4 hours.

Hits

- Excellent flight characteristics.
- Versatility of power choices.
- Detailed instructions for both glow and electric.

Miss

- Tail surfaces are tricky to install.

FLIGHT PERFORMANCE

The Norvel glider powered with the BigMig .061 engine is a nice calm-weather model to catch thermals with. The engine is very easy to start, and it provides about 5 minutes of power to get the glider up to cruising altitude. Once the engine goes offline, how long it stays airborne will depend on your ability to find the rising lift. It can be a lot of fun and a challenge.

• TAKEOFF

The model is intended to be hand-launched; there's nothing more to it than starting the engine, pointing the model's nose into the wind and giving it a light toss. At full power, the model climbs nicely but not at such a steep angle that it's in danger of stalling. In about 5 minutes, you can have the model several hundred feet in the air. In modest wind, it has good yaw control, but in a strong wind, you may find yourself at the wind's mercy, especially if the engine is not running.

• FLIGHT CHARACTERISTICS

This glider is very gentle and a nice stable flyer both with the engine running and when the glider is being "powered" by gravity. Elevator control is good; there's enough control for nice big loops if you dive into the maneuver to gain airspeed. Rudder control with the engine running is good, but you do have to be mindful of the wind direction when you head back home for a landing.

• LANDING

It isn't difficult to land a glider; you just have to manage the flight speed with the elevator. By keeping the nose down, you can stretch the approach so that you can land this model a few steps away from yourself every time. One nice thing about this model is that the duration of each engine run is about the same if you completely fill the tank for each flight. We had a great time playing, "Who can stay up the longest?" because everyone gets the same powered flight time.

If you're looking for something to help you relax, this little powered glider fits the bill.

—Gerry Yarrish

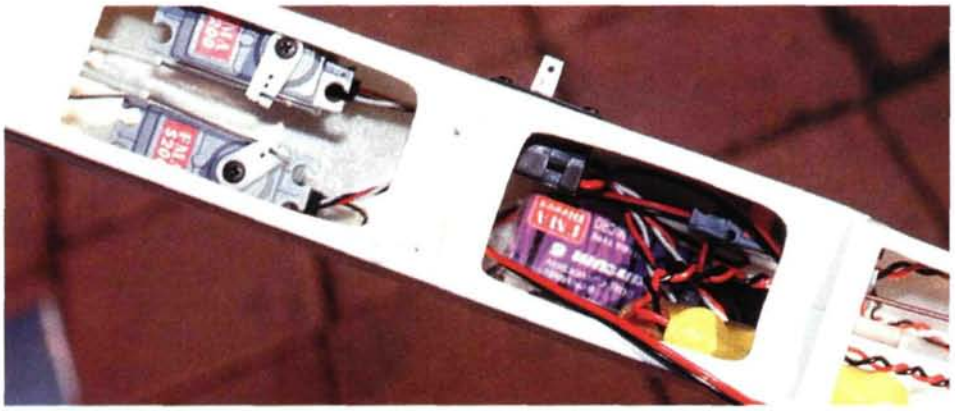
ASSEMBLY

Unlike any other ARF I have built, construction on the GlassAir 400 starts with the canopy rather than the wing. Cut out the canopy along the scribed lines (a good pair of Lexan scissors will do the trick). Drill a 5/32-inch hole in the rear of the cockpit and epoxy in the short dowel. Bevel the half-round canopy former and place it over the dowel, but do *not* glue it! This former gets glued to the canopy. Put the canopy in place and check the fit; trim it as needed. Then, tack-glue the former to the canopy with a drop or two of thick CA. Drill a 5/64-inch pilot hole in the front of the canopy, and secure it with a 3/8-inch screw.

Now, assemble the wing! Test-fit the metal dihedral brace and alignment dowel. Snug is good, but don't tighten them too much; you want to be able to separate the wing halves with little effort but without any slop in the joint. Epoxy the brace and dowel into one wing half only, and make sure that the dihedral brace is angled upward. Remove the covering from over the predrilled wing-bolt holes. Place the wing on the fuselage, and use the holes in the wing as your guide for drilling the fuselage. Drill two 9/64-inch holes in the fuselage's mounting block and tap the holes with the supplied metal self-tapping screws. Then secure the wing to the fuselage with the nylon bolts. Mark the wing where it meets the fuselage, then remove it; these marks will guide your installation of the wing-alignment blocks. These blocks will prevent the rear of the wing from shifting or separating during flight.

It can be a little tricky to attach the horizontal and vertical stabilizers. Unlike most ARFs, the GlassAir has no slots in the fuselage to slide the stabilizers into; they are surface mounted. Remove the covering from the horizontal stabilizer where it is attached to the fuselage, and make sure the open side of the hinge is down.

The GlassAir 400 comes as you see it here, with a fiberglass fuselage and covered wing and tail surfaces. The GlassAir 400 can be built with either a geared Speed 400 or a .049 to .061 glow engine; hardware and instructions for both power options are provided.



The fuselage is narrow, but there is enough room inside for the radio gear. I did not use the supplied servo rails or tape; I chose instead to install my gear with Bob Smith's IC2000 tire glue. It holds things securely, saves a little weight and leaves more room inside to arrange the gear.

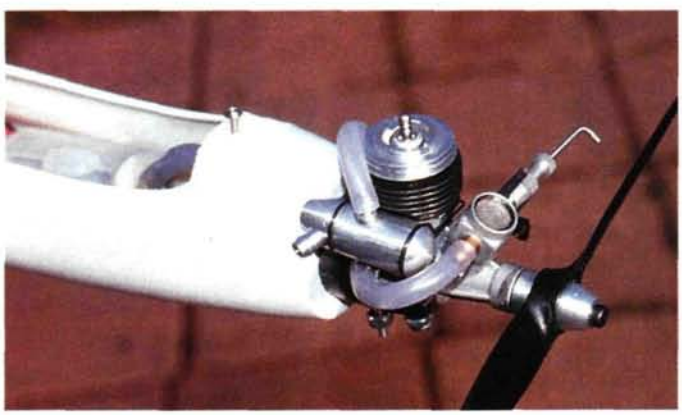
Attach the wing to the fuselage and place both on a flat surface. Support the wing so that each tip is the same distance off the table. The instructions call for 5-minute epoxy, but I used 30-minute to secure the horizontal stabilizer to the fuselage. It gave me more time to work and affords a stronger bond. Make sure that the stabilizer fully contacts the fuselage and is parallel to your work surface. Let the epoxy cure completely before you continue.

The tail surfaces come hinged, but unlike most ARFs', the GlassAir's stabilizers are surface-mounted; they don't fit in a slot in the fuselage. Extra care is required for proper alignment.

The vertical stabilizer is a bit more difficult to install. Mark a line that is 90 degrees from the horizontal stabilizer and in the center of the fuselage. Because there is no slot or groove to hold the stabilizer in place, I was concerned that it might shift while the epoxy cured. On each side of the fuselage, I used a combination square on top of a block to hold the vertical and horizontal stabilizers perpendicular to each other. A small piece of masking tape placed across the front of the vertical stabilizer and the two squares ensured perfect alignment.

When everything has cured, attach the control horns to the elevator and rudder as you would with any model aircraft. Mount the rudder horn on the left side and the elevator horn on the bottom center of the elevator.

I deviated from the instructions when I installed my servos. Since I chose to go glow, I needed three servos, but I did not use the recommended servo rails or servo tape. I secured my servos using Bob Smith's IC2000 tire glue. It is a rubbery black CA used to glue tires onto the rims of RC cars. I have used it before for mounting servos, especially in foam wings and fuses. I used FMA S200 servos for the rudder and elevator and an S100 for the throttle. I mounted the throttle on the left side with the front edge of the forward compartment bisecting the servo. I mounted my 600mAh receiver battery opposite the throttle servo and placed FMA's Quantum 6 sub-micro receiver between them. With the BigMig on the nose, this configuration gave me perfect balance. After you've installed the servos, measure, make and install the pushrods.



I had wanted to try Norvel's BigMig Sport .061 engine; the GlassAir gave me the perfect opportunity. Spinning a Master Airscrew 6x4 prop, it got the plane to gliding altitude in no time.

Following the directions for mounting a glow mount, epoxy the plywood nose ring to the inside of the fuselage. This is what the engine mount will be secured to. Attach the engine mount with four screws, and drill a hole for the throttle pushrod. I tucked a 1-ounce Sullivan fuel tank under the canopy, 2 inches behind the firewall.

The next step is to balance the GlassAir and set the control throws. The center of gravity (CG) is 2 7/16 inches behind the wing's leading edge. The elevator deflection is ½ inch up and down; rudder deflection is 1 inch left and right. When that's finished, you're ready to go.

CONCLUSION

Norvel's GlassAir 400 is an easy-to-build powered glider that lets you fly in spaces that might be too small for faster aircraft. Its gentle manners are a product of its sailplane origins, but the BigMig .061 adds an extra element of fun, and it helps get the GlassAir to good cruising altitude. The fact that it can be fit with either glow or electric power really broadens this model's appeal among modelers of all types. I had a blast with this plane!

Bob Smith Industries, *8060 Morro Rd., Atascadero, CA 93422; (805) 466-1717; fax (805) 466-3683; www.bsiadhesives.com.*

FMA Direct, *9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301) 831-8987; www.fmadirect.com.*

Futaba Corp. of America; *distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826; www.futaba-rc.com.*

Master Airscrew; *distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386; www.masterairscrew.com.*

Norvel, *P.O. Box 3459, San Luis Obispo, CA 93403-3459; (800) 665-9575; (805) 547-8360; fax (805) 547-8365; www.norvel.com.*

Sullivan Products, *One North Haven St., Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443; www.sullivanproducts.com.*

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

An ARF classic warbird that flies as good as it looks

MRC/ALTECH

EZ P-51D Mustang

by Craig Trachten

Over the past few years, it has been a pleasure to build, fly and even review a few samples of OK Model Co.'s EZ line of aircraft. With the introduction of its P-51D Mustang, OK Model has topped itself once again. Distributed by MRC/Altech, the EZ Mustang is a .40- to .46-size aircraft that has a brushed aluminum finish and details such as rivets and weathering that contribute greatly to its authenticity. It is constructed in the typical EZ fashion: plastic foam and Mylar over lite-ply. It also comes with a set of retracts—a nice touch!

SPECIFICATIONS

Model: EZ P-51D Mustang

Manufacturer: MRC/Altech

Distributor: MRC/Altech

Type: scale warbird

Length: 46.4 in.

Weight: 5.75 to 5.94 lb. (6.35 lb., as tested)

Wingspan: 54.7 in.

Wing area: 532 sq. in.

Wing loading: 24.9 to 25.7 oz./sq. ft. (27.5 oz./sq. ft., as tested)

Engine req'd: .40 to .45 2-stroke or .50 to .70 4-stroke

Engine used: O.S. .70 Surpass II

Prop: APC 11x6

Radio req'd: 5-channel

Radio used: Futaba 8UAPF w/six Futaba servos

Street price: $340

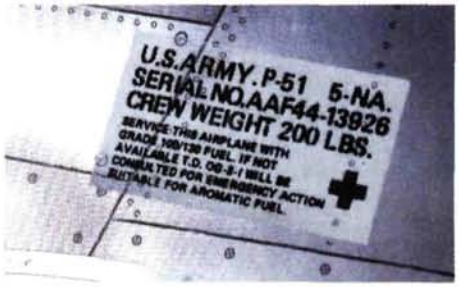
Features: highly detailed fuselage comprised of a lite-ply structure covered with a laminated skin made from a plastic-foam base, a synthetic paper layer with graphics and a layer of clear Mylar; chrome-plated plastic spinner; retracts; vacuum-formed plastic cowl.

Comments: the fit and finish of the Mustang's kit components were perfect. The only thing better than seeing this aircraft hanging from my ceiling is watching it take a high-speed, on-the-deck pass at the flying field!

Hits
- Highly detailed airframe.
- Parts are easy to install.

Misses
- Retract installation instructions were vague.

The EZ Mustang P-51D comes with everything you see here.



The quality and detail in the finish of the P-51D is exceptional. Note the depiction of rivets and weathering in addition to the graphics.

THE KIT

The fit and finish of the kit components earned a perfect 10 from me.

As with most ARFs, the supplied pushrods are wood dowels with wires attached at each end, but I use Dave Brown's fiberglass pushrods, no. 5400, in all my aircraft.

I like the fact that at the beginning of each construction sequence in the instruction manual, the required materials are listed and pictured. This allows you to round up all of the necessary parts before you begin construction. The documentation falls a bit short, however, with respect to the English translation and, in some cases,

FLIGHT PERFORMANCE

When the Mustang arrived, I weighed it dry, and it tipped the scales at 6.3 pounds—5.8 ounces more than the high end of the manufacturer's projected flying-weight range (including ¾ ounce of tail weight necessary for balance). Then again, the O.S. Surpass .70 is the largest engine recommended for this design. This slight amount of overweight notwithstanding, I felt quite confident about the Mustang's capabilities in both high-speed and slow-flight modes. After all, OK Models has standardized the very effective airfoils it uses in the EZ series, and the EZ Zero (as seen in the September 2000 issue of *Model Airplane News*) was a fantastic flyer. At a wing loading of 27.5 ounces, the Mustang's loading was only .72 ounce more than the Zero's. As you read, you'll find that I was not at all disappointed by the P-51's flight performance.

• TAXIING AND TAKEOFF

With its long tail moment and its wide and relatively low main-gear stance, the EZ Mustang couldn't be a better-behaved tail dragger—especially on a paved surface. The model would be equally well-behaved on grass, if not for the small, 2.5-inch scale wheels. If you fly off grass—even well-groomed grass—I strongly recommend that you use the largest wheels that will fit into the wheel wells; I believe these would be about 3 inches max. Small scale wheels aside, this model ground-handles extremely well, even in a crosswind.

Because of the model's long tail moment, rollout for takeoff requires only moderate right rudder. On grass, full up-elevator is definitely required at the beginning of the takeoff rollout; this is slowly neutralized as the model picks up speed. All in all, the Mustang takes off easily—for a tail-dragger, that is.

• HIGH-SPEED AND AEROBATIC

At full throttle, the EZ Mustang turns into a high-speed ride on rails; it's very fast. In deference to the new engine, I ran only a 6-inch-pitch prop—an APC 13x6—and the Mustang burned up the sky. I plan to try a 12x9 or an 11x10 and then get out the radar gun. With retracts and a somewhat thin—by sport-model standards—airfoil, this model moves out with a vengeance. Despite the speed factor, however, the Mustang instills a lot of confidence in the pilot because of its dead-on-accurate flight-control demeanor. It goes exactly where you point it. The control surfaces have been mounted precisely and are extremely effective—especially the full-length ailerons. When it comes to control-surface throw, make absolutely sure you follow the instructions to the letter. If you improvise here, you could end up with an overly twitchy, hard-to-handle model.

When it comes to aerobatics, with this much power, any semblance of scale-like flight goes right out the window at full throttle. With the .70 Surpass II, this P-51 flies more like an AMA pattern ship. Rolls are axial; spin entry and exit are quick, and inverted flight is much the same as upright flight. I bet you've never seen a P-51 do a nearly perfect avalanche before! Plus, the Mustang's almost rectangular rudder was effective for maneuvers such as knife-edge that require top-rudder input.

All of this crisp aerobatic stuff is great and is a testament to the model's design. If, however, you think a P-51 looks a bit preposterous in knife-edge flight, then go for less power. A Saito .56 4-stroke or any sport .40 2-stroke will do very nicely.

• LANDING AND SLOW FLIGHT

As I've already said, OK Model has something special going on in its airfoils. I don't know what it is—and Mr. Takamatsu, the owner of OK Model, isn't telling—but the Mustang certainly isn't the first EZ model I've ever flown that's equipped with a rather fast airfoil that also manages to slow up very nicely on final approach. Simply put, with all of its blinding high-speed ability, the Mustang is very well behaved during slow flight. Now, don't think you can fly it like your favorite trainer .40 design, but as far as sport-scale designs go, it's up there with the very best.

At the end of the day (the flying day, that is), this Mustang's flying characteristics are the best of both worlds. It has rock-solid high-speed excitement as well as a reassuring positive-control feel at slow speeds. I like the way this model flies—a whole lot. —*Chris Chianelli*

the construction photos. Since this probably is not your first aircraft, the minor problems with the documentation shouldn't scare you away. As with any kit, it's a good idea to dry-assemble the pieces before you glue them permanently into place. The pushrods were the only supplied hardware that I chose not to use.

The included retracts are a good addition to the kit.

ASSEMBLY

Begin the wing construction by installing the aileron servos in each wing half. It would have been nice if a pull string for the servo wire had already been installed, but it was easy enough to drop one through.

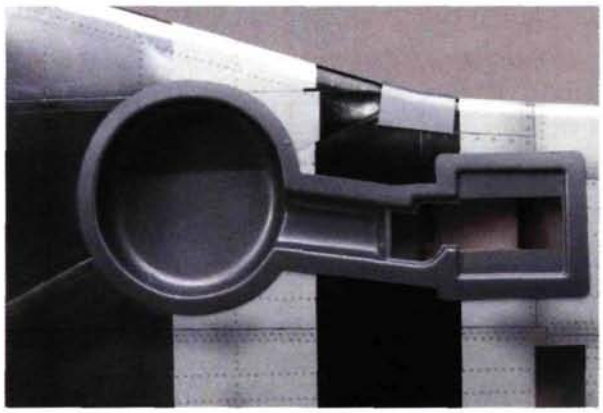
The kit includes a cover plate that goes over the servos. Make sure to mount the servos low enough to allow the plate to lay flat; however, if you mount them too low, the servo arms will bind on the plate. Guess how I found that out.

When the servo positions were correct, I attached the cover plates with Bob Smith's IC-2000 flexible glue. After the cover plates are secure, simply attach the control horns to the ailerons and install the pushrods.

Mount the retracts and retract servo next. Open the area in the left wing to accommodate your retract servo and carve out the servo mount. Then attach the servo to the mount and install the mount in the wing. This is the easiest way to achieve proper servo height.

Measure and bend the retract pushrods then snake the rods through the wing and complete the retract installation; then join the wing halves as shown in the instructions.

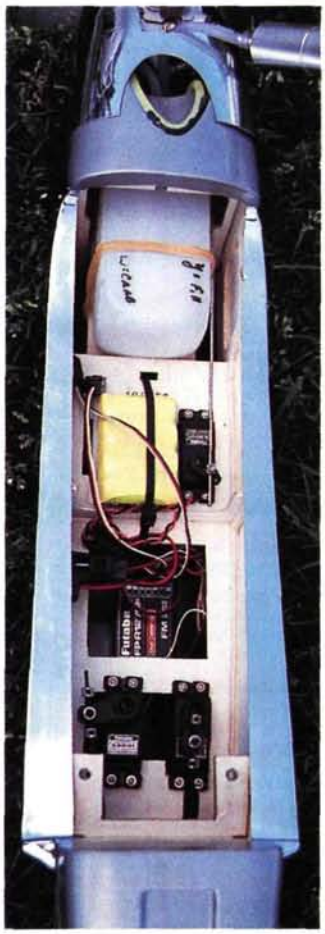
The manual does not explain how to install the two Z-bends through the servo disc with the given space and rod length. I solved the problem by using a long, two-arm servo horn. On one of the retracts, I rotated the Z-bend 180 degrees, then inserted one Z through the bottom of one side of the arm and the other through the top. The long horn gave me enough added length to "hook" the rods around the output shaft of the servo, which helped attain full throw without binding.



The molded-plastic wheel wells come installed in the wing. This makes it easier to install the retracts.

The remaining construction can be compared to riding a skateboard in San Francisco—it's downhill all the way. Secure the main wing to the fuselage, then attach the plastic fairing (with air scoop) using the IC-2000.

The engine is mounted on the aircraft in the typical manner, but the top half of the cowl blends in to become part of the fuselage. This makes it exceptionally easy to accurately measure and cut all openings in the cowl bottom. It also contributes to the great look of this aircraft.

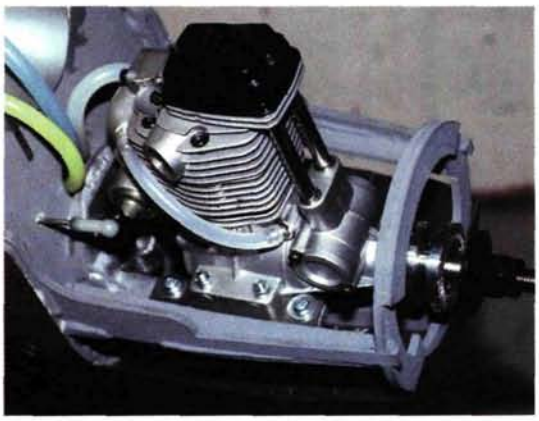


My Futaba radio gear fit perfectly into the P-51D's radio box. I used a total of six Futaba servos, both digital and analog.

The internal elevator pushrods are another terrific feature of this kit. Only the rudder pushrod is visible; it exits the lower rear of the fuselage.

I installed an oversize, Du-Bro 12-ounce fuel tank in the nose of the Mustang and used a three-line configuration with a clunk on the third fill line. This makes defueling quick and easy.

Next, install the radio gear of your choice. I used my Futaba 8UAFS with a combination of digital and analog Futaba servos.



A close-up image of the powerful O.S. .70 Surpass II. Note the three-line configuration used for fueling.

Everyone knows that airplanes can't fly themselves; a pilot is required! This kit includes a sheet of vacuum-formed parts that will become your pilot and seatback. The canopy comes with trim tape to put the finishing touches on the glass. Simply add some Testors flat military-colored paint, and you will end up with a nice-looking cockpit.

This kit should be at the top of your wish list. Be good to yourself because this aircraft belongs in your hangar. ✈

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

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OK Model Co.; *distributed by MRC/Altech, 80 Newfield Ave., Edison, NJ 08818-6312; (732) 225-6360; fax (732) 225-0091; www.modelrectifier.com.*

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Whether on glow or electric power, this little bipe performs!

CLANCY AVIATION

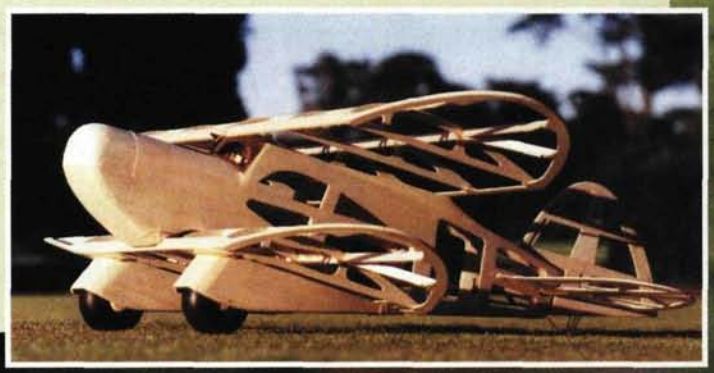
Stagger Bee

by Thayer Syme

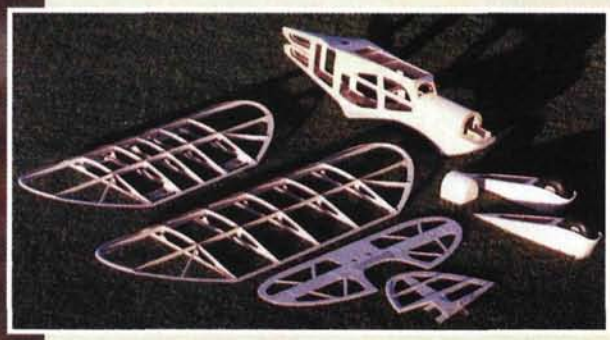
Andy Clancy of Clancy Aviation has done it again! Blending the classic Beech Staggerwing and homebuilt Stitts Sky Baby with his trademark dose of whimsy, the fertile mind that gave us the Lazy Bee has come up with a new ship—the Stagger Bee biplane—for all of his fans.

Although the Stagger Bee is a built-up balsa model, constructing it is not laborious. All the balsa pieces are precision die-cut and of very nice quality. Two sheets of die-cut, 1/32-inch, plywood parts are included for areas that need to be strengthened. The only pieces of wood that have to be shaped are a few bits of triangle stock and one piece of sheeting for the upper wing fillet. No sticks and stringers need to be fitted, no slabs of heavy sheet or block need to be shaped, and only four holes need to be drilled. Almost all of the joints are keyed with slots and tabs.

The wood was not as light as I would have liked, but Andy assured me that the model would be light enough to fly well.



The Stagger Bee skeleton. The extensive lightening efforts are quite apparent.



The framework for the Stagger Bee is ready for covering.

PHOTOS BY THAYER SYME

Because there are fewer parts in this model, there are higher strength demands on each of them, and consequently, the heavier wood was necessary. The model is also designed to be powered by up to a .30 4-stroke, so a certain mass of wood is required to absorb the energy and vibration of such a large powerplant.

All of the ply pieces need to be laminated from two 1/32-inch sheets, subsequently the modeler ends up with 1/16-inch-thick parts that are cleanly die-cut and very strong—with no perceptible weight penalty. The kit includes a

SPECIFICATIONS

Model: Stagger Bee

Manufacturer: Clancy Aviation

Type: electric or glow sport flyer

Wingspans (top/bottom): 29.5 in./25.5 in.

Chord: 10 in.

Wing area: 470 sq. in.

Length: 30 in.

Weight: 18 to 36 oz.; 23 to 35 oz. (as built, ready to fly)

Power req'd: .061 to .20 2-stroke, .20 to .30 4-stroke or Speed 400 to Turbo 10 motor.

Power used: Modelair-Tech geared Speed 400 on 8 to 10, 600mAh Ni-Cds; Graupner G-480 on 8, 800mAh Ni-Cds; AstroFlight 020 on 8, 800 Ni-Cds; and AstroFlight 05 on 8, 1700mAh Ni-Cds (see text for props used)

Flight duration: 5 to 10 minutes

Radio req'd: 3-channel

Radios used: Hitec Focus, two Hitec HS-50 servos, Hitec 555 receiver

Price: $89

Features: die-cut balsa and ply parts; Trexler wheels; rubber bands; four sheets of full-size plan; illustrated instructions; lightweight, clear laminating film; hardware; music wire; a razor blade.

Comments: the Stagger Bee is a straightforward, quick model to build and a delight to fly. Because it's a unique, fun design, it also attracts a lot of attention at the flying field.

Hits

- High-quality kit parts.
- Wide performance range.
- Excellent flyer.

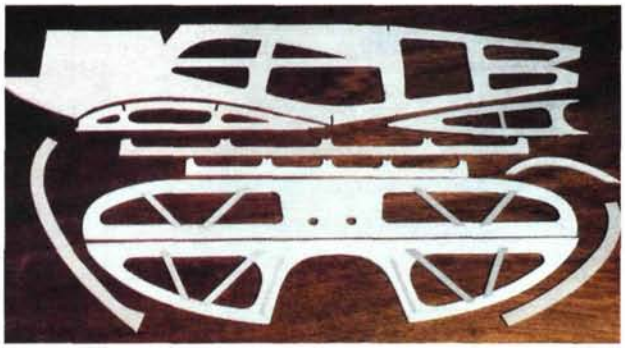
Misses

- Some kit pieces should be lightened for better electric-power performance (see text).

high-quality assortment of hardware: music wire for the pushrods and tailskid; lightweight clear covering for the wings and tail; a pair of Trexler wheels; rubber bands; four full-size plan sheets; detailed instructions with illustrations and even a razor blade.

RADIO AND POWER SYSTEMS

The manual recommends that you use the lightest radio gear you can afford. Although almost anything will fit, I used two Hitec HS-50 servos and the very reliable and reasonably light Hitec 555 receiver.



These parts show most of the lightening efforts made before assembly.

Depending on the chosen power system, the Stagger Bee can be built for a wide performance range. With a geared Speed 400 or 480, or a glow .061 to .10, it's perfect for patrolling the local baseball field or cul-de-sac and offers enough power to perform aerobatics and yet still fly slowly enough for a small area. (Clancy prefers and recommends a Speed

FLIGHT PERFORMANCE

A main goal of this review was to provide a number of electric "recipes" for the power setup. I bench-tested more than 50 motor/battery/prop combinations and then flight-tested the most promising. Here are a few of the successful power combinations tried, and my general impressions of how the Stagger Bee flew with each of them. Note that no single power setup can be considered as the best; each has its own characteristics.

While testing power setups, I tried to isolate as many variables as I could. I used only Sanyo Ni-Cd cells. I used several props I had on hand in addition to several new APC Thin Electric props. I found these new APC props quite effective; they provided ample thrust while often showing less static current draw than other props of similar sizes. I am quite pleased by their performance and expect to use them often on future projects.

I first tried two geared Speed 400 motors: the 100-SP and the 100-ST, from Modelair-Tech. Both have 2.14:1 ratios but different motor windings. While neither of these setups will win any races, they are practical power sources. The APC 10x8 prop works well with the 100-SP motor on 10, 600AAE cells or the 100-ST on 8, 500AR cells. The flight characteristics are fine for a leisurely evening tour of the neighborhood park. A graceful takeoff followed by circuits of the field, a touch-and-go or two and the odd loop or snap roll really makes for enjoyable flying. You have to lower the nose to gain speed for loops. To be fair to the design and the Modelair-Tech drives, the kit really is a little too much for a Speed 400. If you use a Speed 400, be very attentive to weight while building.

The Graupner G-480 (gear ratio 3.45:1) recommended by Clancy Aviation is a solid little power package with the recommended 8, 800mAh cells and an APC 11x8.5 prop. This system was noticeably more powerful than the Speed 400 system. Takeoffs were much quicker, and the model climbed faster. Loops from level flight were now possible, and, all in all, the model just inspired more confidence. The 4- to 5-ounce weight increase caused by using the G-480 does cause the model to glide slightly faster with power off, but with only a touch of throttle it can be flown just about as slowly for landing and flybys. I consider this to be the minimum setup for someone who's interested in doing aerobatics more than occasionally. This is also a great setup for someone who wants to buy all the needed parts from one source and be confident that the Stagger Bee will work as expected.

Next up was the AstroFlight brushless 020 with 4.4:1 planetary gearing using the same 8, 800mAh pack as before and an 11x10 APC. Weight was similar to the 480 setup. Duration increased noticeably with this motor turning the same props, and I found myself flying at lower power settings for a similar performance. The AstroFlight 020P is a very good match for the Stagger Bee. I recommend this jewel for any enthusiast who wants the satisfaction that comes from owning and operating very high-quality gear.

The final motor I flew with was an Astro Brushless 05, geared at 3.3:1. Despite my using only part of the motor's potential, it really lit up the Stagger Bee. The Astro 05 is rated for up to 30 amps on 8 cells. Using an APC Thin Electric 11x5.5 prop, static testing shows 15 amps and 9.5 volts at 6,500rpm. The APC 11x7 prop static-tested at 17 amps and 9.4 volts at 6,200rpm. Both combos provided all the power I needed.

Takeoffs from a paved surface occur about as quickly as I could want. Throttle forward, a touch of right rudder, stick back, and the Bee is off and climbing hard at about 60 degrees for the first 50 feet or so. Flying from grass is not a problem. Our local schoolyard is pockmarked with gopher holes, but that doesn't slow the Stagger Bee at all. A little aft stick, and the Astro 05 and Trexlers bounce the Stagger Bee along for 15 to 20 feet before it is up and flying. The model should hover easily and accelerate vertically when propped for 30 amps.

Smaller and lighter cells will also be something to investigate. The 8x1700 battery used weighs 1 pound, and the 10 to 12 minutes of duration it provides are more than adequate. Considering the relatively low current draw, NiMH cells might be the way to go, with subsequent weight savings. I expect that most people would consider the Stagger Bee overpowered with this motor, but it sure is a whole lot of fun!

One advantage of having too much power is quite compelling: with such a large prop on such a small span, you can flood the wing with airflow if you get too low and slow while landing. Just punch it, and the model starts to fly again. I was surprised that the torque of such a rapid throttle application did not seem to roll the model significantly.

GLOW FLYING

I have only flown my model with electric systems, but I have seen a couple of glow-powered Stagger Bees in flight. They are both quite impressive and maneuverable. A 2-stroke .15 provides ample power for exciting aerobatics, including outside loops. Takeoffs from grass are easy to do. Most sport fliers should be quite happy with this amount of power. The second glow model is a 4-channel wingeron prototype powered with a Saito .30 4-stroke. Abundant power and precise control define the flight characteristics of that combination.

480.) On the higher end of performance, the airframe is designed to handle up to a .30 4-stroke, and with this much power, the model is pretty impressive!

I tried two geared Speed 400s, an AstroFlight brushless 020 with a planetary gear reduction and an Astro conventionally geared 05. See "Flight Performance" for a full review of these different power setups; for now, though, let's start building.

CONSTRUCTION

The manual recommends that you label the parts with a soft pencil before you separate them from their carrier sheets. Most parts have two numbers: one identifies the part, and the other indicates the construction step in which it is used.

The fuselage is a pretty conventional sheet-wood box. First add the doublers, and then the crosspieces. Slots and tabs help maintain alignment, and the fuselage really stiffens up after you've added the top and bottom sheeting and the wing fillets. The fillets are about the only place where careful fitting is needed. The fillet pieces are cut a little oversize to accommodate any variations that might creep in when you frame the fuselage. After a few strokes with a sanding block, it was easy to close the gaps as I joined them to the fuselage.

A good look at the Stagger Bee's unique planform and generous wing area.

Clancy includes a solid plywood firewall to use with glow engines, and a separate firewall to use with electric motors; this has a significant lightening hole that also allows longer gear-drive systems to slide into the nose without major surgery. The motor mount is built of balsa sheet, triangle stock and a plywood plate. This plate anchors hooks for the rubber bands that hold down the motor and allow the motor to be removed easily. With the fuselage framed, it was on to the tail surfaces. The full flying rudder can be built up quickly, and the stab and elevator are made of solid sheet.

The landing-gear pants are next. They are simple plywood-reinforced sheet boxes. A few licks with a coarse sanding block shaped the fronts nicely. Interestingly, the landing gear is attached to the wing with rubber bands. While unconventional, this technique is very effective. Hard landings rarely cause much damage beyond popping the rubber bands—and that is much preferred to having to repeatedly repair the lower wing.

The wings went together really quickly. With the required landing-gear mounts and extra bracing, the lower wing took about an hour to frame up. With just 18 pieces of wood, the top wing was assembled and ready for sanding in less than 20 minutes.

At this point, I built the optional cowl for the nose. There isn't any material in the kit for this part, so you're on your own. A light block or a few bits of ¼-inch sheet will do quite well. A scrap of dowel and some small magnets provide all the security needed.

LIGHTENING THE MODEL

Before starting construction, I spent some time lightening the kit's pieces because I wanted to fly the model slowly in tight spaces with the lightest motor: the geared Speed 400. For this type of flying, weight is the enemy and must be reduced wherever practical. I also used very light covering and radio gear. The lightening holes in my fuselage saved just ⅕ ounce because the sides were already pretty light. I removed more than 2½ ounces from the wing ribs, wingtips and horizontal tail surfaces. That's a significant weight reduction when flying with the less powerful systems.

For all flight tests, I added 3 ounces of ballast to the Stagger Bee to allow me to more accurately evaluate the kit as it came out of the box. Removing the ballast caused a noticeable difference in flight characteristics; I think my effort in lightening my kit was justified.

FINISHING

Clancy recommends the lightest finish you can manage. The model has a lot of wing area, and standard plastic films will add weight. A lightweight, clear laminating film is included in the kit for the wings and rudder. If you fly with electric power, a light coat or two of spray paint is recommended for the wood. To add some color to the wings, you could also lightly paint the inside of the film before you use it, or use one of the light films, such as Airspan or Micafilm. I tried a combination of Airspan and Litespan glued on with Balsaloc and am quite pleased with the results. If you plan to use a glow engine, a lightweight plastic film would provide enough fuel protection.

OPTIONS

Not one to sit on his laurels, Andy Clancy has a few more tricks up his sleeve for the Stagger Bee. In development are wingeron control, optional longer wings and floats. Prototypes flown with the wingerons exhibit crisp control with roll rates in excess of 360 degrees per second; when you remember that these roll rates are achieved at relatively low flight speeds, it's even more impressive. Inverted flight seems quite stable, despite the high-lift, flat-bottom airfoil.

The longer wings provide more lift and stability when flying at lower speeds. I flew my model with an extended upper wing, and it made a noticeable difference. Stretching both wings should make the model easier to fly in smaller spaces.

Floats for the Stagger Bee are still in the early development stages as I write this article; I can't wait for them!

FLYING NOTES

Before taking off, you will likely want to investigate the ground handling. Who could resist letting the Stagger Bee waddle around the driveway a bit on its Trexlers? The model has a steerable tailskid that doubles as the hinge pins for the rudder. This offers excellent ground handling on anything but a paved surface. The Stagger Bee tracks smoothly, and its large rudder is very effective during takeoffs and landings. Since I fly a fair amount from a paved surface, I bent a new piece of wire to accommodate a tailwheel. The stock tailskid will serve you well if you are not inclined to taxi much.

The Stagger Bee is a delightful model to fly. For patrolling a neighborhood field, it can be tamed with small control throws and low-power systems. It can also do some pretty impressive gyrations: boost the control throws out to as far as you can arrange, add a more potent power system, and things will get exciting in a hurry. A bit of exponential throw or dual rates isn't a bad idea to help smooth out takeoffs and landings. Once in the air, the Stagger Bee happily responds to whatever you give it; it is very responsive to both rudder and elevator controls. The rudder response is quite strong despite the only dihedral being the tapered wingtips. Accidental snaprolls are not a problem. When forced to stall, the Stagger Bee seems to just mush ahead as long as the rudder is straight.

The Stagger Bee is a high-drag design. Though this might be a detriment to flight efficiency, there are advantages. For instance, controlling the landing can be

The Stagger Bee even has a starring role in the upcoming CBS movie, "The Last Brickmaker in America."

easier than with a more "glider-like" performance. I found myself flying the downwind and base legs of the landing pattern higher than I usually do. When turning onto final, reducing the power while holding up the nose creates a lot of drag, the airspeed bleeds off, and the descent rate picks up. At this point, it is a simple matter to ease in some throttle to slow the descent and then position the model exactly where you want it for landing. This is a great model for those informal spot-landing contests at the field.

CONCLUSION

I really enjoyed building and flying the Stagger Bee. It's a unique design and can be constructed quite rapidly. Its flight characteristics and durability should help keep it active for quite a while. Though I wouldn't recommend it as a first trainer, it would be a great addition to your fleet once you have a few other designs under your belt. The Stagger Bee is also a whole lot of fun for anyone who appreciates the timeless appeal of a cabin biplane.

APC Props; distributed by Landing Products; www.apcprop.com.
AstroFlight Inc., 13311 Beach Ave., Marina del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637; www.astroflight.com.
Clancy Aviation, P.O. Box 4125, Mesa, AZ 85211-4125; (480) 649-1534; fax (480) 649-9040; www.clancyaviation.com.
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Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.
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MODEL AIRPLANE NEWS
ENGINE
REVIEW

A rotating-cylinder-valve 4-stroke

RCV
120-SP

by Gerry Yarrish

Whenever I show the new beehive-shaped RCV 120-SP engine to my modeling buddies, the first thing they always ask is, "Oh! Is it a Wankel?" I tell them, "No, it's a rotating-cylinder-valve engine." "A what?" is usually their second question. Designed by Keith Lawes, this unconventional engine is a big departure from the standard model airplane engine-design layout philosophy. Manufactured by RCV Engines Ltd., the 120-SP is the second in its RCV line; the first was a .60-size engine. The 120-SP operates much like a 4-stroke engine but with two big differences: first, the piston travel is in line with the prop shaft/piston sleeve component, and second, the prop revolves at half the crankshaft speed. Let's take a closer look.

A highly unconventional "4-stroke" engine, the RCV 120-SP produces lots of torque and turns very large props.

THE BIG DIFFERENCE

The most unusual thing about this engine is that the piston's cylinder sleeve is supported by two ball bearings that permit it to revolve and drive the propeller. At the front of the engine, the prop shaft is an integral part of the sleeve. At the cylinder sleeve's base is a large bevel gear that engages a smaller bevel gear driven by the crankshaft. The piston and connecting rod that drive the crankshaft are inside the sleeve and travel fore and aft in line with the prop shaft.

Another interesting feature of the RCV engines is they are started with a hex-shaped starter wand that engages the crankshaft well behind and at a 90-degree angle to the propeller. Since the crankshaft gear is half the diameter of the cylinder gear, the engine's prop rpm are gear-reduced at a ratio of 2:1, which greatly increases the engine's torque output. (More on this later.)

The cylinder is made of steel, and a port opening is machined where the 5/16-inch prop shaft and the cylinder body meet; this port leads to the combustion chamber. This arrangement forms a rotary valve directly behind the front shaft bearing. The single opening acts as both the intake and the exhaust port as it revolves under the carburetor and exhaust portions of the engine case. The intake, ignition and exhaust portions of the engine operating cycle are not quite 120 degrees apart from one another as can be seen by the front view shown in Figure 1.

PISTON AND CRANK

The piston is machined of aluminum and has a conventional cast-iron piston ring for proper sealing. The wristpin is press-fit within the piston body. Since the piston traverses within a revolving cylinder wall, it isn't surprising that the ring isn't pinned into a stationary position. Also, according to the manufacturer, the cylinder wall is

SPECIFICATIONS

Engine: RCV 120-SP

Manufacturer: RCV Engines Ltd.

Displacement: 1.20ci (20cc)

Weight: 36.4 oz. (without muffler)

Length: 4.92 in. (125mm)

Engine diameter: 3.10 in. (78mm)

Prop shaft diameter: 5/16 in.

RPM range: 1,200 – 6,000

Max. horsepower: 1.8hp @ 5,800rpm (prop speed); 11,600rpm (crank speed)

Price: $399

Comments: the RCV 120-SP is a unique and interesting powerplant that produces a lot of torque compared with other engines of similar displacement. It operates on a 4-stroke engine cycle and has a 2:1 gear-reduced prop rpm. It operates with large-diameter props that have roughly twice the pitch normally used. The engine has a crankcase-starting socket that accepts a hex-starting wand. The wand is an optional extra ($22.25), and one size fits all RCV engines.

Figure 1. Engine cross-section detail

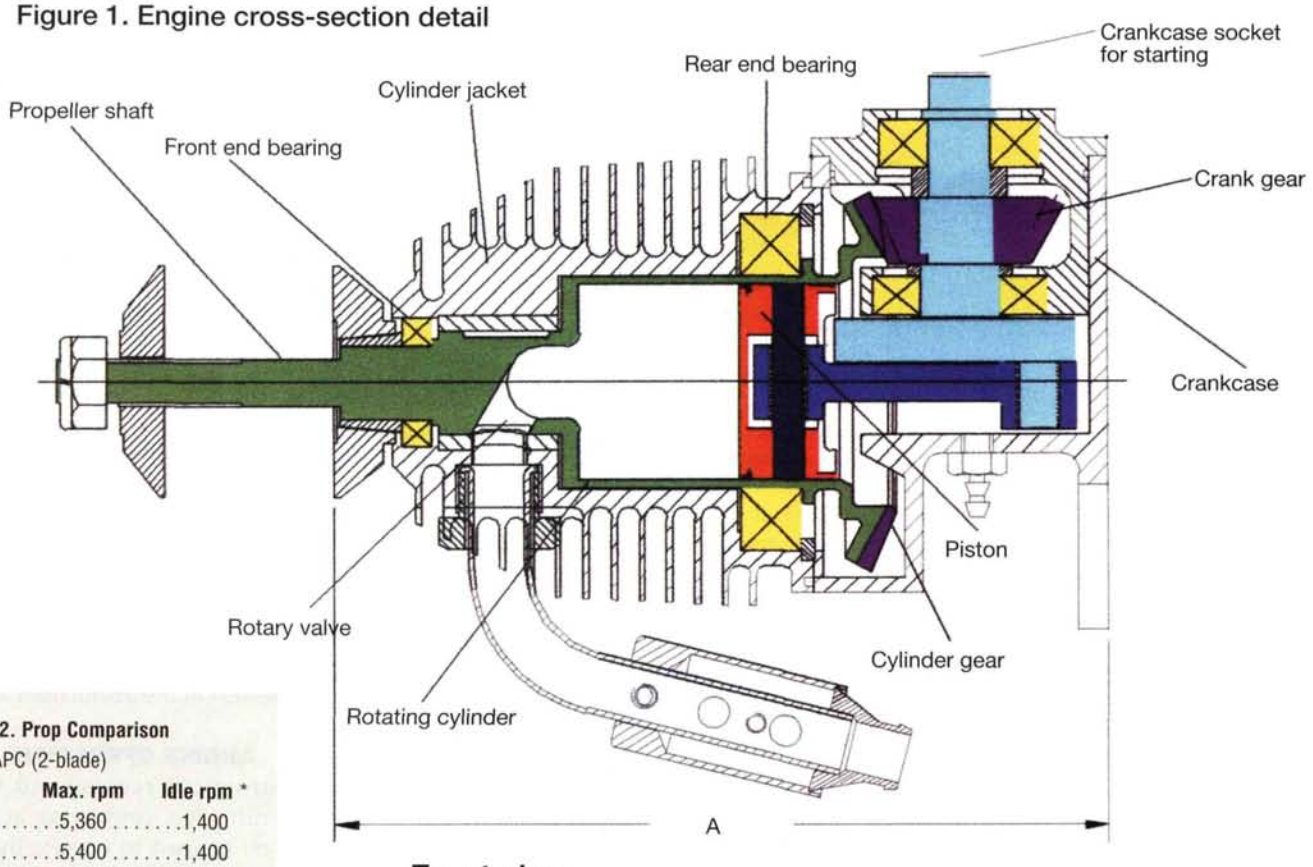


Figure 2. Prop Comparison

Type: APC (2-blade)

Size	Max. rpm	Idle rpm *
18x16	5,360	1,400
18x14	5,400	1,400
18x12	5,460	1,450
17.5x18	4,930	1,500
17x18	5,000	1,400
17x13	5,550	1,500
17x12.5	5,560	1,500
17x12	5,700	1,450
16x16	5,500	1,500
16.5x14	5,650	1,500
16.5x13	5,700	1,500
16x12	5,750	1,550

Type: APC (4-blade)

15.5x12	5,300	1,600*

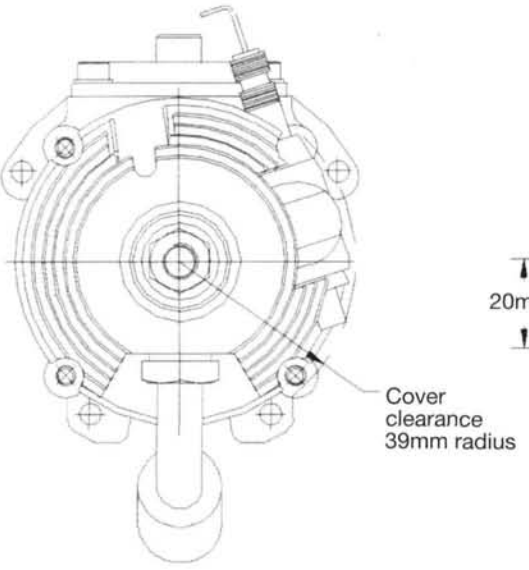
Type: Menz (2-blade wood)

18x10	4,900	1,390*

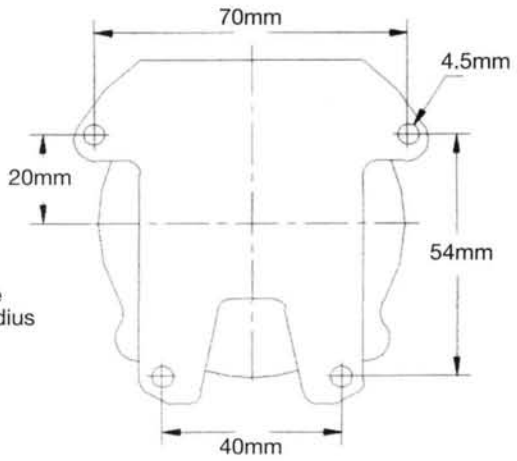
*with glow driver

Air temperature: 51 degrees F
Barometric pressure: 30.04 in.
Humidity: 29 percent

Front view



Mounting dimensions

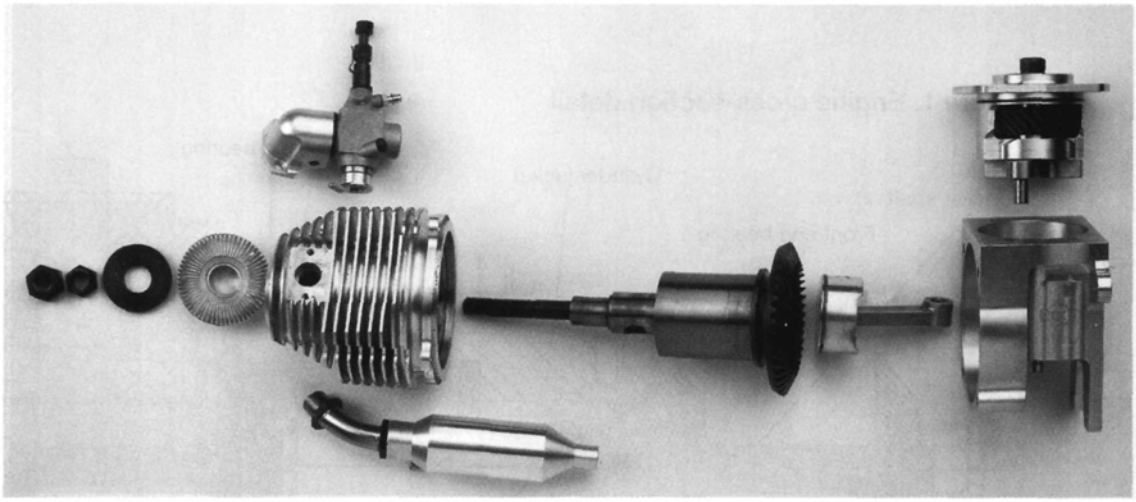


not tapered toward the combustion chamber as it would be in a typical ABC engine. The connecting rod is machined of solid aluminum and is bushed at both ends. The lubrication hole drilled into the conrod's lower end faces toward the piston instead of away from it as is found in conventional setups. I suspect that this is because very little lubrication passes over the back of the crankshaft pin, as most of the fuel charge enters and exits from above the piston. During engine operation, however, I noted more than adequate lubrication of all internals.

The crankshaft is housed in a separate engine-case assembly that also forms the engine-mount portion of the case. The crank is counterbalanced and is supported by two needle bearings that are seated in the aluminum housing bolted to the main engine case and sealed with an O-ring. The crank end that's opposite the crank pin terminates with a large replaceable capscrew. This capscrew engages the hex-shaped starting wand used to start the engine.

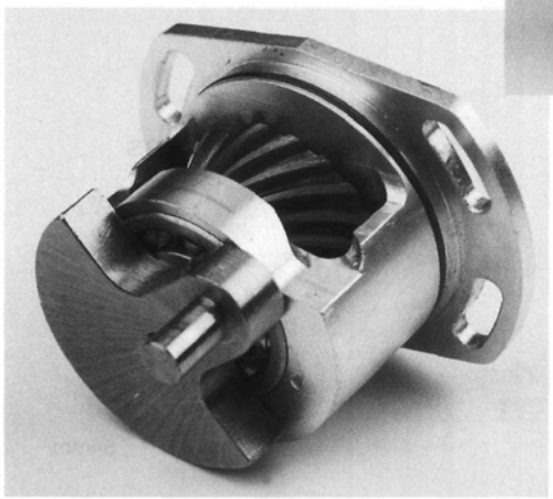
The engine case (cylinder jacket) is

made of a solid piece of aluminum and is deeply finned to dissipate engine heat. The cylinder housing and the crank housing are held together with four cap-head bolts. This arrangement has an unanticipated benefit: the engine case halves can be assembled in any of four positions without changing the engine's timing or operation. This means you can adjust the engine's layout and the position of the starting socket relative to the exhaust pipe. The engine comes with the socket placed 180 degrees from the exhaust. Depending on your engine installation, you can have the exhaust pipe facing down and the starting socket on the left, top, right or bottom of the engine. This is a nice touch that any scale modeler can appreciate.



Here's the engine's internal layout. The biggest difference between this engine and a more conventional one is that the piston is housed within the same part that turns the prop.

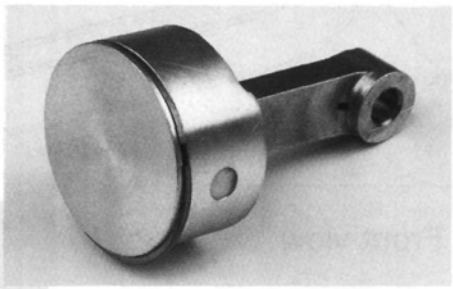
Opposite the starting socket is the crankcase breather fitting. This fitting shouldn't be connected to the fuel tank; it should be left to outside air pressure as is done with most conventional 4-stroke engines. As an experiment, I connected the muffler's pressure tap to the crankcase breather with a short length of fuel tubing. I found no advantage in doing this, as there was no increase or decrease in engine performance.



This assembly houses the crankshaft and crank gear as well as the support bearing and starting socket. The unit seats into the crankcase.

INTAKE, IGNITION AND EXHAUST

The carburetor is a standard 2-needle arrangement with a ½-inch-diameter carb barrel and a 0.336-inch (8.5mm) intake diameter. The carb is attached to a 90-degree intake manifold and is sealed with an O-ring. The manifold bolts onto the engine case with two cap-head screws. The venturi faces aft, and the high-end needle faces up. Throttle linkage attached to the throttle arm fits easily in a straight-line arrangement that makes the pushrod placement uncomplicated.



The ringed piston looks quite ordinary. Note that the oil hole drilled into the conrod's lower end faces toward the piston.

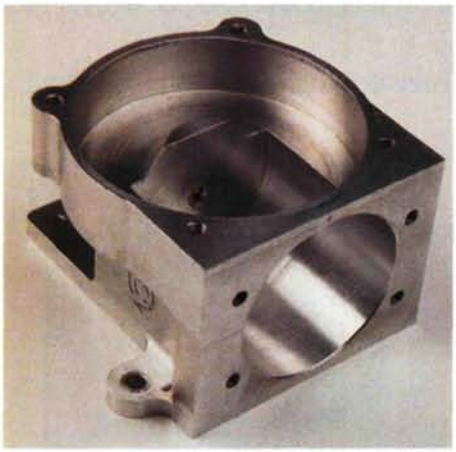
The exhaust port is a bit more than 90 degrees from the carb and it faces downward. The exhaust pipe and muffler are identical to those found with standard 4-stroke engines, and the pipe screws into the engine case. A jam nut securely holds the pipe in position. You can rotate the pipe and exhaust to face anywhere in a 360-degree radius. (Of course, you can't operate the engine with the muffler pointed forward, as it would interfere with the propeller.)

The engine came with an O.S. F glow plug, which is the plug recommended in the instructions. You should not use a plug with an idler bar, as this would protrude too deeply into the combustion chamber and could possibly jam the engine. Because the glow plug is so closely positioned to the propeller, you should not use a clip-on glow-driver battery to start the engine. For additional safety, I installed a Sullivan Head-Lock glow-driver extension on the plug and positioned the energizer receptacle well aft of the prop. This step is highly recommended in the instructions as well.

ENGINE OPERATION

The instructions recommend that 10-percent-nitro fuel containing at least 15 percent oil be used to operate the 120-SP engine. In all my tests, I used Powermaster fuel with a 15 percent nitro and an 18 percent oil content. I attached the engine to my break-in stand—a plywood firewall and

Above: here you can clearly see the rotating-sleeve/prop-shaft component. Note the single port cut into the large forward portion. It acts as both the intake and exhaust ports. Left: at the aft end of the sleeve is a large helical gear. It mates with the small gear that's driven by the crankshaft at the back of the engine case.



Above: shown here is the cylinder jacket or main engine case. Note the large main bearing that supports the sleeve and allows it to revolve. Below: the crankcase is CNC-machined from a large block of aluminum. It also serves as the engine's mount.

box structure screwed onto an old picnic table. To adjust the throttle, I used a 12-inch-long Du-Bro pushrod and plastic clevis that passes through a hole in the firewall, and I pressed a short length of fuel tubing into the hole to act as a throttle-position friction lock. The recommended break-in prop is an APC 18x12. Do not attempt to start the engine by turning the propeller; the gear reduction of the prop output shaft makes that very difficult. By using the engine's starter socket and wand, engine starts are quick and effortless.

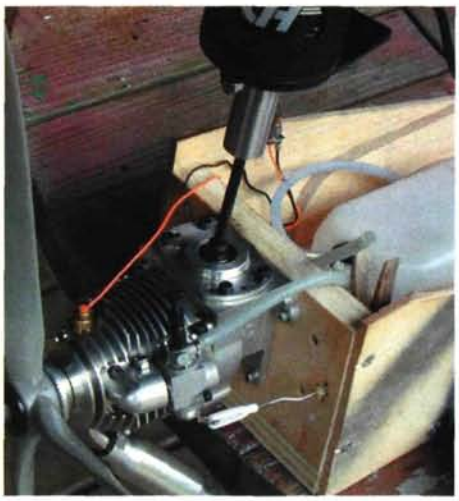
The low-end needle valve is factory set, and I did not have to adjust it. To start the engine, I opened the high-end needle three full turns and opened the throttle to about the ¼ position. To start the engine, your starting wand has to turn opposite (clockwise) to the prop rotation. I turned on the glow driver and engaged the electric starting motor and wand. The engine started instantly and settled into a medium rpm range. Then I opened both the throttle and the high-end needle until the engine ran at full throttle with a very rich mixture at about 4,000rpm. I ran the engine this way for several 15-minute intervals before I began to lean the mixture. After about five tanks of fuel, throttle response was solid, and the engine ran very smoothly and reliably.

The RCV engine has a unique sound that's somewhere between a 2-stroke and 4-stroke engine's cadence. When the mixture is set properly, the engine sounds slightly rich and has a "poppy" sound. Starts are easy, and throttle transition is smooth from idle to full open. If the mixture is too lean, the engine is difficult to start at low throttle settings. Though it runs cleanly from high to medium throttle settings, the engine tends to die at low settings. An overly rich setting makes the engine run rough and begin to sputter at idle—especially when the glow igniter is switched off.

Until the engine was fully broken in, there was about a 200 to 250rpm drop when I turned off the glow igniter. After break-in, the rpm drop is only about 100. Finding the maximum rpm setting is exactly the same as with any other model engine: lean the mixture until the rpm peaks and then back it off a few clicks to the rich side. Turning an 18x12 APC prop resulted in a maximum rpm reading of between 5,200 and 5,500 revs; the idle was a very nice 1,400 to 1,500rpm.

RUNNING BIG-PITCH PROPS

At first, the rpm reading of the RCV 120-SP seems low. This is true until you remember that the engine output is geared 2:1. Reducing the rpm by half, basically doubles the torque, so the 120-SP easily turns much larger props than a conventional 4-stroke engine can, and it doesn't overheat. To compensate for the lower prop rpm, you have to turn props that have roughly twice the normal pitch. Recom-mended prop sizes for the 120-SP are 2-blade 16x16, 17x13, 18x12, 18x14, 18x16 and 20x12 props and the 15.5x12 4-blade prop. Landing Products, as well as RCV Engines Ltd., has several of the APC high-pitch Pattern Aircraft props, so getting them is as easy as a phone call. See the prop table (Figure 2) for the rpm readings I found while running the engine. For general sport flying, the 18x12 2-blade prop is recommended, and the 15.5x12 4-blade prop is recommended for the faster sport-flying designs. The 18x10 and the 20x12 props produce a good amount of thrust and are well suited for large, slow, scale models.



Only start the engine with the behind-the-prop-starting wand. It is both easier and safer to start the engine this way.

Having only one more moving part than a typical 2-stroke engine (the rotating cylinder), the RCV 120-SP offers many of the advantages of a large 4-stroke engine without complicated overhead valves, cams and lifter rods. The engine produces more usable torque than a conventional 2-stroke engine of the same displacement and effectively turns large-diameter props. Its streamlined shape permits easy engine installation in tight-fitting cowls, and its unique revolving-cylinder-valve design sets it apart from other conventional powerplants. If you value high torque and slow-turning big props, and if you like "thinking out of the box," then you'll find a lot to appreciate in this engine. ✈

For safety, use a glow-plug extension wire and a remotely located glow-driver connector. The glow plug is extremely close to the prop, and you should not attach your Ni-Cd driver battery directly to the plug.

Du-Bro Products, *P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; www.dubro.com.*

Landing Products, *122 Harter Ave., Woodland, CA 95776; (916) 661-0399.*

PowerMaster, *P.O. Box 650, Elgin, TX 78621; (512) 285-9595; fax (512) 285-9400.*

RCV Engines Ltd., *4 Haviland Rd., Ferndown Industrial Estate, Wimborne, Dorset, England, BH21 7RF; +44 1202 877044; fax +44 (0) 1202 871836; www.rcvengines.com.*

RCV Engines U.S. distributor, *Wilcat Fuels, 206 Stephens Dr., Nicholsville, KY 40356; (859) 885-5619.*

Sullivan Products, *One North Haven St., Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443; www.sullivanproducts.com.*

A ½-scale Formula One design with TOC performance!

SPECIFICATIONS

Type: sport-scale aerobatic/Formula One racer

Scale: 50 percent (wing is stretched to 75 percent)

Span: 134 in.

Length: 110 in.

Wing area: 3,000 sq. in.

Weight: 28 to 35 lb.

Wing loading: 23.04 oz./sq. ft. @ 30 lb.

Engine req'd: 100cc and up

Engine used: 3W-140cc Aircraft Intl. twin-cylinder

Radio req'd: 4-channel (aileron, elevator, rudder and throttle)

Comments: designed by Dan Santich, the Miss San Bernardino is a 50-percent sport-scale Formula One racer. Basic balsa and plywood are used throughout, and fiberglass cowl and wheel pants are available. The wing and tail surfaces have been enlarged, and with a powerful engine, the model is capable of TOC-level aerobatics. Compared with other aerobatic aircraft of similar size, the Miss San Bernardino is much less expensive to build, with basic materials costing between $300 and $400.

Miss San Bernardino

by Dan Santich

When you see an airplane, what do you think of? The first thing I think of is whether it's worthy of becoming a model. To get my attention, it has to have good looks, personality and performance. That is why I've always had an eye for racers, especially the Formula Ones. Powered by 190ci engines, these small racers go like scalded cats and have the look of airborne ballerinas. One racer was, in fact, named Ballerina. Some of the early racers were downright ugly. (One was named Beetle Bomb!) But a few were absolutely beautiful—namely, the Shoestring, Cosmic Wind, Cassutt and Ole Tiger. Several of these racers were modified from time to time and would change owners; this led to many different colors, markings and configurations. Such was the case with the Miss San Bernardino, which was subsequently renamed Wingwax/La Jollita. The airframe underwent several modifications that included a larger vertical fin and rudder and the installation of a bubble canopy. With a wingspan of only 17 feet, the full-size racer was not very large. I created a model that is close to 50-percent scale, but I enlarged the wing, fin and stab for stability.

PHOTOS BY DAN SANTICH

FLIGHT PERFORMANCE

The model's flight performance is absolutely honest, satisfying and challenging. I say challenging because it is capable of doing maneuvers I can only dream of doing; yet, in the right hands, I believe it to be a viable Tournament of Champions (TOC) contender. It is very easy to fly. It tracks straight and true, and the landings are something to behold. They are almost effortless, and why not? With over 3,000 square inches of wing area and a weight of 35 pounds (loaded), you almost have sailplane Reynolds numbers. Keep the center of gravity (CG) at or forward of the location shown, not aft.

• TAKEOFF AND LANDING

Takeoffs are a sheer delight. Right rudder is needed during takeoff. The tail comes up by itself, but the model won't come off the ground without positive up-elevator input. At about ½ throttle and a small amount of up, the model flies right off in about 100 feet. Landings are simply a matter of throttling back. It tracks like a pattern ship all the way in.

• HIGH-SPEED PERFORMANCE

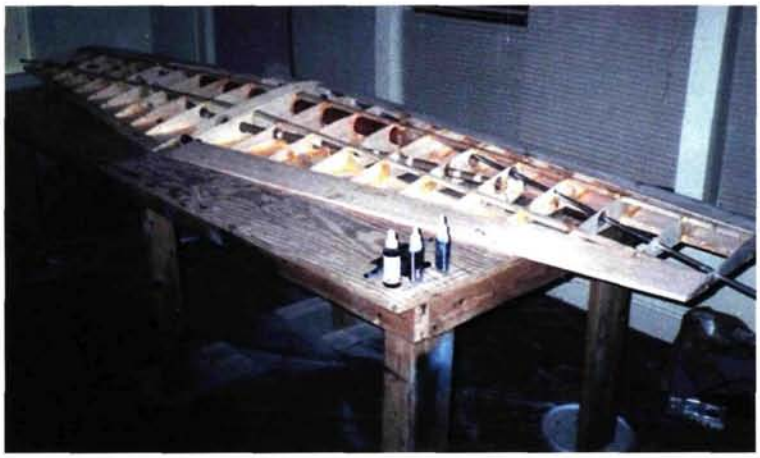
In a word, delightful; control handling feels solid all the way. Built as a true Formula One racer, the wing would have been only 96 inches long, and the wing loading would have been much higher. With its 134-inch wing (that's actually 75-percent scale), the model just keeps on flying until you flare for landing.

• LOW-SPEED PERFORMANCE

The model remains predictable at lower speeds and is very easy to land. It has a solid descent rate and is easy to slow down because of its weight-to-drag ratio. Keep the nose down, and it won't stall.

• AEROBATICS

Any TOC maneuver is possible, and vertical performance is a factor of the engine size. Barn-door ailerons are shown on the plan. Roll is not snappy unless you have maximum aileron travel. If you want to do 3D maneuvers, you can extend the ailerons to full span with no problem. All maneuvers are big and impressive.

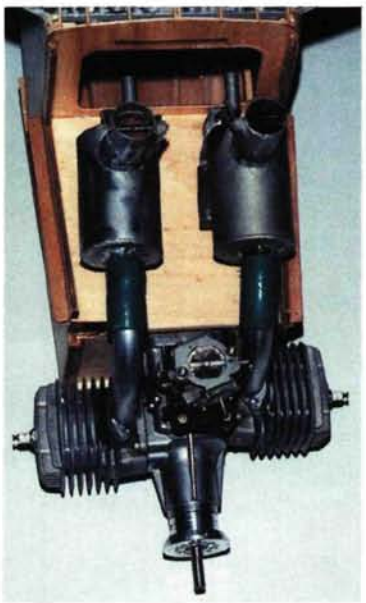


The wing panels are assembled upside-down over the plan. Here, the wings are being fitted with the joiner tube and sleeves.

The landing gear is soft-mounted using Sullivan 1/4-20 rubber mounts.

THE MODEL

This model isn't intended for the Scale Masters! I designed it to look good and to have practical performance. What do I mean by "practical performance"? Simply put, it is a Sunday fun-to-fly model that doesn't look like everything else on the field, yet it flies like a thoroughbred. I use a 3W-140 engine from Aircraft Intl. with a 6-inch Tru-Turn spinner and a 28x14 prop and am very pleased with its performance. It has unlimited vertical climb. Because the model's structure is very solid, it can handle a larger displacement engine if you desire. A 4-cylinder 3W powerplant would be something to behold on this model! The most important thing is proper balance. You want to select an engine that will allow the finished model to balance correctly without adding ballast. The 3W-140 will do this; it weighs 10 pounds with two mufflers. I recommend something in this weight range. You can also shift things such as servos, batteries, etc., around to achieve balance.



The engine installation is straightforward. Note the two baffles in the exhaust pipes; they divert smoke to the wingtip smoke setup.

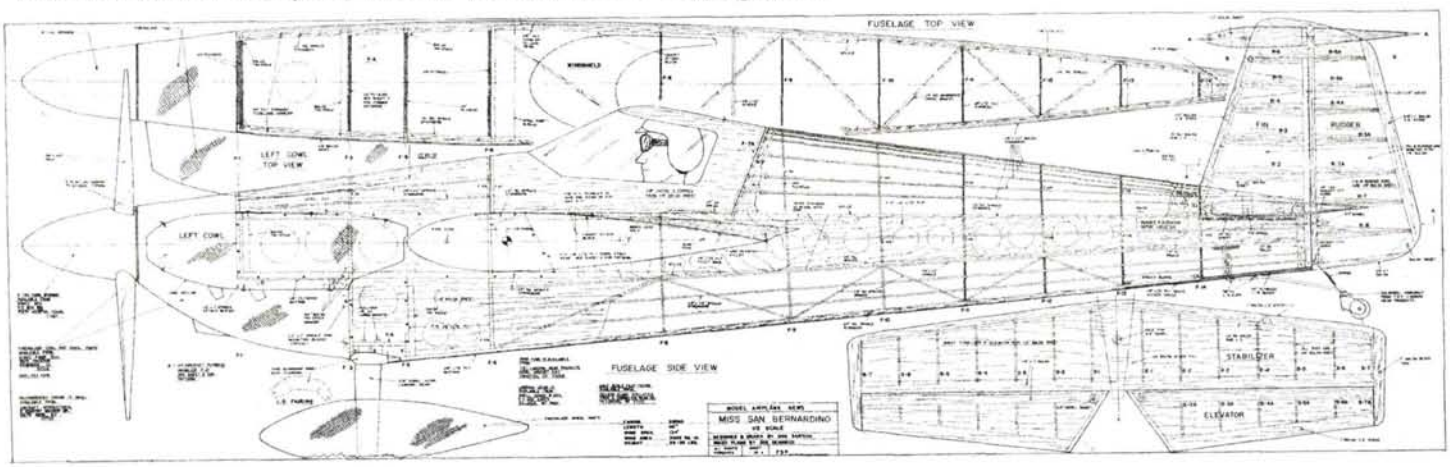
Here, you see the rudder and elevator servos housed in the aft portion of the fuselage.

You can build two versions of this model; both are shown on the plan. Either one will get your blood flowing and make your modeling buddies envious.

CONSTRUCTION

The first thing you need is a 4x8-foot sheet of 3/4-inch plywood to build on. Make sure it is absolutely flat! I always start with the fuselage, then I build the stab, followed by the wing panels. The fuselage is built around a box that consists of the front bulkheads F1, F2, F3, F4, F5 and F6. The fuselage sides are laminated with an 1/8-inch plywood doubler from F1 back to F8, where an 1/8-inch lite-ply doubler continues all the way to the rear. After you've glued these doublers into place, add the 1/2-inch-square and 1/4-inch-square spruce stringers to the inside of each side. Place the sides upside-down on your building board and glue the bulkheads into place along a centerline drawn on the board. When these are dry, glue the tail ends together and then—with the fuselage off the building board—add the remaining bulkheads. Now you can add the upper portions of the bulkheads. Glue the

To order the full-size plan, turn to "RCStore.com" on page 150.



stringers, landing-gear block and cross-braces into place and cover the sheeted top section with 1/8-inch balsa.

The top center portion of the fuselage is removable to provide access to the radio and fuel tank. It is a built-up structure using 1/8-inch balsa sheeted over the F6C and F7A bulkheads. There are several ways to secure this hatch: hinge it on one side and use a release latch on the other, or key the hatch with plywood tabs and run screws from the outside. I hinged mine and used a BVM hatch latch at the front and back. The windshield is a flat piece of 0.030 clear plastic wrapped over the cockpit opening. You can glue and screw it into position after cutting it to shape.

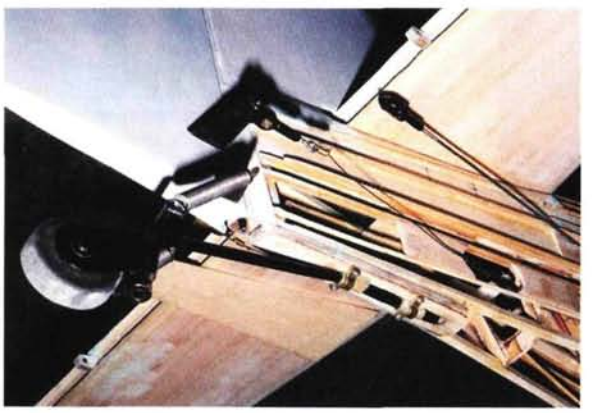
As you can see in the photo, the wing-tube sleeve runs from side to side inside the fuselage. When you cut the holes for the sleeve, be sure to position them exactly square to the fuselage centerline. The wing panels plug into place, and a large aluminum joining tube supports the wing. I use a wing tube from TnT Landing Gear Products. To secure the panels in place, attach two 10-32 studs to the root rib so that their threaded portions fit into holes in the fuselage sides. I use a plastic dresser-drawer knob that has a 10-32 brass insert in it as sort of a "wing nut," and I thread it onto the wing bolt. These studs also serve to properly align the wing incidence.

The horizontal stab, fin, rudder and elevator halves are straightforward in construction and require no further explanation; just keep them as light and as straight as possible. All the ribs are made from 1/8-inch balsa sheet, and all the control surfaces are fully sheeted with 1/8-inch balsa. The rudder throw should be 3 inches left and right, and the elevator throw should be 1 inch up and 1 inch down.

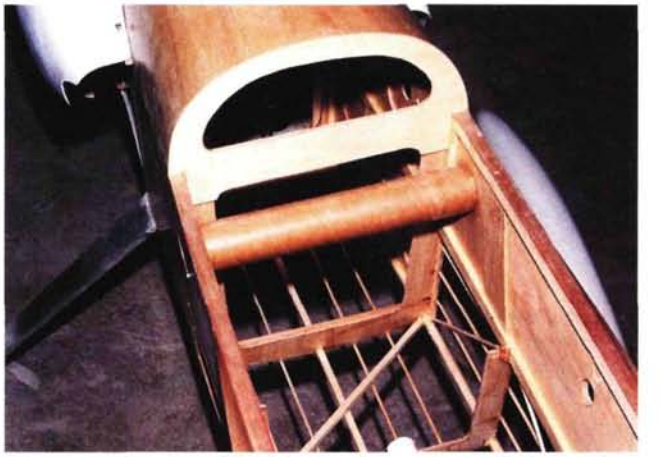
Note the 1/4-inch-square cross-bracing used to stiffen the fuselage.

FIBERGLASS AND LANDING GEAR

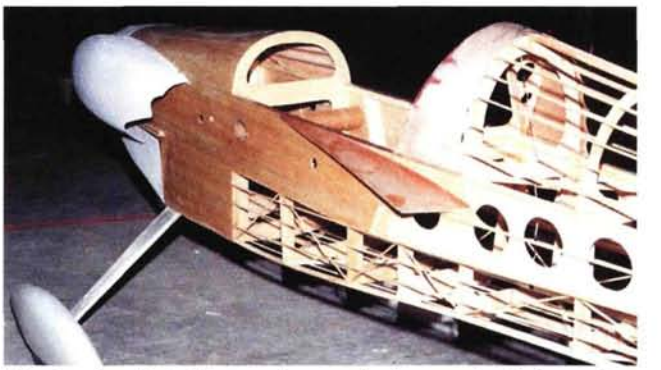
The cowl, cheeks and wheel pants are fiberglass. In my "How To" article, also in this issue, I explain an easy method for fabricating these parts. If you don't want to make them yourself, you can order the engine cowl and wheel pants from Stan's Fiber Tech. The landing gear is formed from 3/8-inch duralumin and is available from Abell Hobby.



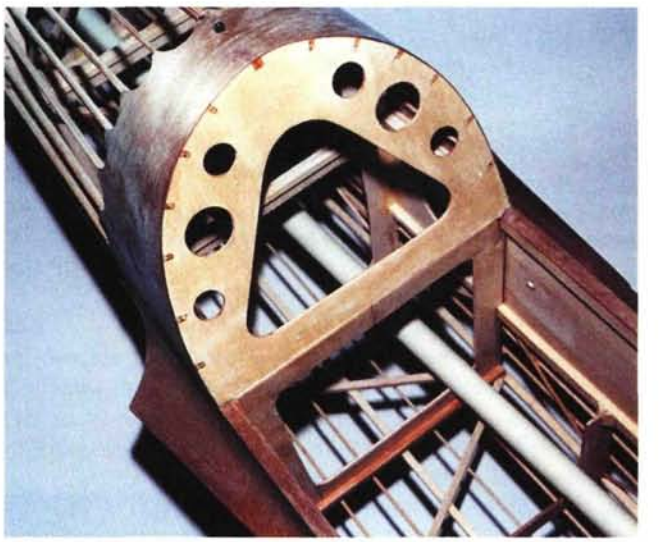
The TnT tailwheel unit fits nicely with the design of the model. The steering is attached to the rudder with large springs.



The forward section of the fuselage has a sleeve that accepts the wing-joiner tube. Be sure to install the sleeve precisely as shown on the plans.

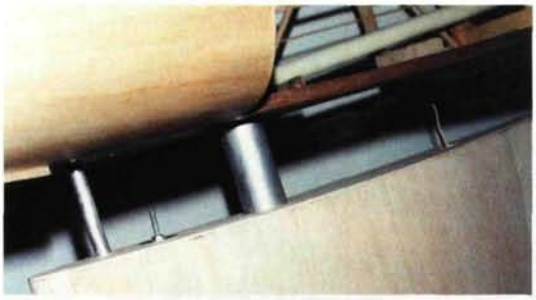


The fuselage is built around a wooden box made of plywood that supports the bulkheads. The front of the fuselage is sheeted; fiberglass parts complete the nose.



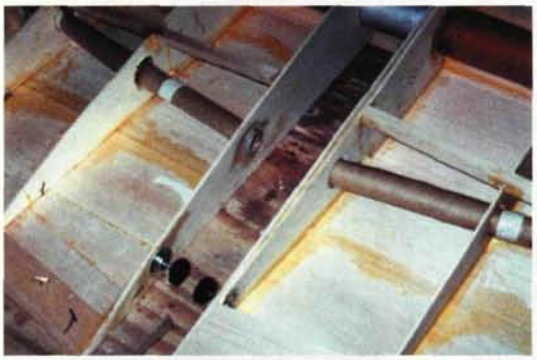
The plywood parts have lightening holes to keep the weight down. Note the many stringers that give the fuselage its shape. The top of the fuselage is removable.

The wing panel's root rib is shown. Note the two threaded studs used to hold the panel in place.



The wing panels plug into the fuselage and are held in place by the threaded studs shown here. The small-diameter metal tube at the LE is for the wingtip smoke setup.

I use a plastic dresser-drawer knob screwed onto the threaded studs to hold the wings against the fuselage sides.



This bottom view of the wing panels shows the paper tubes used to route the aileron servo leads.

WING

This model has a big wing. Because of its size, you have to be prudent in your wood selection. Try to use only light-grade balsa for the ribs and sheeting. Assemble each wing half one at a time, bottom side up. The wing has no dihedral, but the taper of the ribs from root to tip gives it a dihedral effect.

Pin the forward ½-inch-square spruce spar to your building board and glue the ribs into place from the root end out. Block up the ribs so that they are all even, and add the rear spars. Glue the leading and trailing edges into place and add the wing-tube sleeve. Determine the servo location and add the mounting blocks. I have not shown the servos on the plan, since everyone does this differently; however, you should use at least two servos per aileron. Also, be sure to cut holes in the ribs for the servo leads. I use a tube rolled out of craft paper. When all this is completed, add your wing sheeting, balsa tips and capstrips. If you use balsa wood for the spars, I recommend that you glue vertical-grain ⅛-inch balsa between them and between each wing rib.

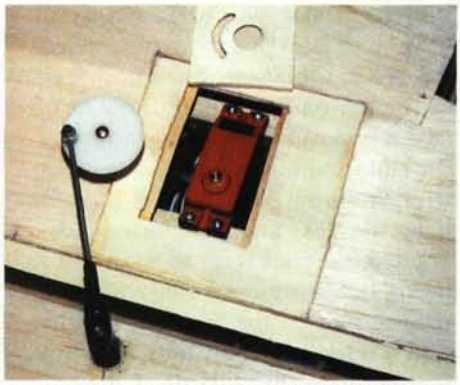
When both wings are finished, slip the wing tubes into both wing halves and block them up at the center to determine whether one is heavier than the other. If necessary, add weight accordingly. It is essential that each wing half weigh the same. To begin, set your aileron throw to 1 inch up and 1 inch down, then adjust to suit your flying style.

FINISHING

Paint your fiberglass parts with your favorite spray paint. I like Rust-Oleum from the hardware store. I covered the remainder of the model with Ultracote, but you can choose anything you like. This plane would be beautiful covered in fabric, such as F&M Enterprises Stits Lite or Nelson fabric, then painted. Use your craftsmanship and skill and be creative. You could even cover the front portion of the fuselage with aluminum and add rivets and panel detail. By the way, Jerry Nelson sells a ½-scale pilot figure that looks great in the cockpit.

RADIO INSTALLATION

I use two giant-scale servos for the elevator (one for each half), two for the rudder and four for the ailerons (two per aileron). Because of the large control surfaces, I also used metal-geared servos. With an MPI voltage splitter, I use two 3000mAh packs for the servos and a separate 1800mAh pack for the receiver. I like this setup because if you stall a servo, it won't affect the receiver voltage. I also have a smoke system with a wingtip smoke setup. I tap into the exhaust with ¾-inch aluminum tubes and route them out the wingtips. I put a servo-operated baffle in each of the exhaust pipes; it diverts the smoke to the wingtips. This system works very well.



A typical aileron-servo installation is shown here. Use two servos per aileron.

The Miss San Bernardino is a great flying, giant-scale model that stands out from the rest of the big models at the flying field. It has wonderful flight characteristics because of its relatively low wing loading and is easy to land. I hope you enjoy your model as much as I do mine. ✈

The completed model with the fiberglass parts and canopy attached. Finish the model however you like. I used Ultracote film.

***Abell Hobby & Mfg. Co.**, 314 9th St. W., P.O. Box 22573, Billings, MT 59104; (406) 259-4882; www.abellrc.com.*

***Aircraft Intl.**, 8 Country Meadow Dr., Colts Neck, NJ 07722; (732) 761-0997; fax (732) 761-8585; www.aircraft-intl.com.*

***Bob Violett Models (BVM)**, 170 State Rd. 419, Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020; www.bvmjets.com.*

***F&M Enterprises**, 22522 Auburn Dale Dr., El Toro, CA 92630; (949) 583-1455; www.stits.com.*

***Maxx Products Intl. (MPI)**, 815 Oakwood Rd., Unit D, Lake Zurich, IL 60047; (847) 438-2233; fax (847) 438-2898; www.maxxprod.com.*

***Nelson Hobby Specialties**, 394 S.W. 211th Ave., Aloha, OR 97006; toll-free (877) 263-5766; (503) 259-8899; www.nelsonhobby.com.*

***Stan's Fiber Tech**, 2575 Jackson St., Riverside, CA 92503; (909) 352-4758; www.stansonline.com.*

***TnT Landing Gear Products Ltd.**, 10530 Airport Hwy., Swanton, OH 43558; (419) 868-5408; fax (419) 868-5409; www.tntlandinggear.com.*

***Tru-Turn Spinners/Romco Mfg.**, P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630; www.tru-turn.com.*

***Ultracote**; distributed by Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (773) 626-9550; fax (773) 626-9566; www.goldbergmodels.com.*

by Chris Chianelli

GWS Tiger Moth

Watching a de Havilland Tiger Moth fly is a special experience—kind of like listening to a string quartet play Johann Pachelbel's "Canon" while sailing on a calm ocean at sunset. I'm talking sheer grace here. With the GWS Tiger Moth, you can experience this brand of aerial elegance within the confines of a softball field or even a gymnasium. I've been an RC modeler for 30 years, and weaving this pretty little vintage bipe around the infield of a local softball field as I stood on the pitcher's mound made me feel the excitement of the novice once again. I call it big-time fun with a tiny RC model.

As you can see from the kit contents, the parts count is low, and that means shorter building time.

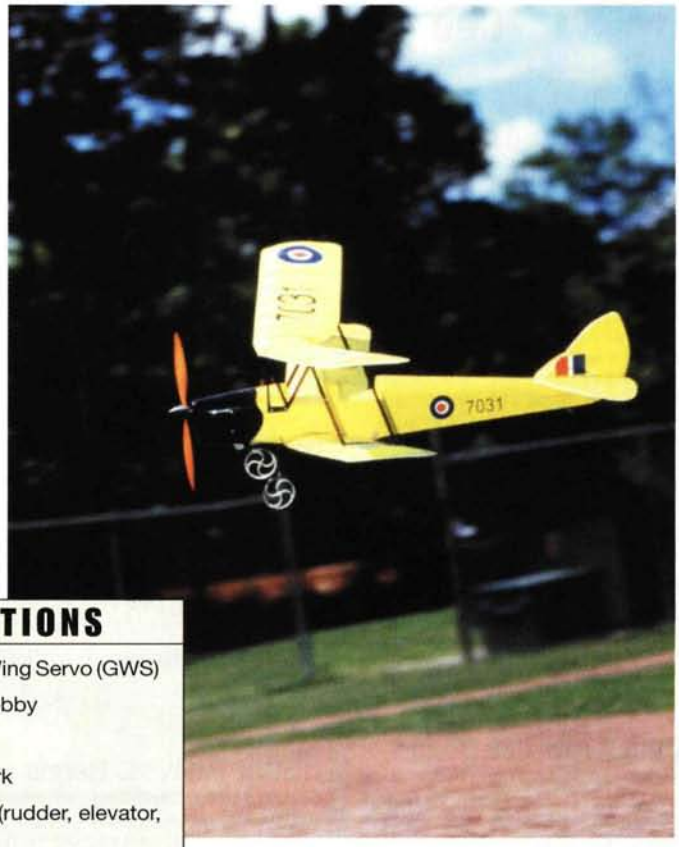
THE KIT AND CONSTRUCTION

When I hear the word "kit," images of balsa and plywood bundles come to mind; I'm talking lots and lots of parts. As you can see from the photo, the Moth's parts count amounts to a mere 35 or so. Low parts count notwithstanding, everything except the radio and speed controller is right there in the box—even glue! One of the kit's nicest features is the well-written, full-color (that's right; full color), 18-page instruction booklet.

Because most of its components are foam, for the moderately experienced modeler, building the Moth shouldn't go past four to five hours. I have only one bit of advice that is not in the instructions: the struts are made of ABS plastic that has a very glossy finish. Before you glue the struts to the wings, I suggest you roughen 1/16 to 1/8 inch of both sides of both ends of the struts to ensure a better adhesion. If you use epoxy, as we did (a recommended option in the instruction booklet), this is particularly important, as epoxy doesn't adhere well to high-gloss surfaces.

FLIGHT PERFORMANCE

From the moment the Tiger Moth left my hand, I could tell it was one solid flyer. A few slow-flyer and park-flyer designs of just a year or so ago have given models of this type a reputation—undeserved, for the most part—of



The GWS flight pack includes a GWR-4P 4-channel FM receiver, a CS50 speed control, a 150mAh battery pack and two GWS Pico (standard) servos. Packs are available for JR, Futaba, Hitec and Airtronics radios. Price is $95. The crystal must be purchased separately.

While there's there plenty of space in the radio compartment for the GWS flight pack—and I highly recommend it—other radio gear will fit just as well.

SPECIFICATIONS

Manufacturer: Grand Wing Servo (GWS)

Distributor: Horizon Hobby

Model: Tiger Moth

Flying style: Indoor, park

Operations: 3-channel (rudder, elevator, throttle)

Flying speed: 8.5 to 13.1 ft./sec.

Construction: Foam

Motor: GWS DX-A

Prop: 9x7

Wingspan: 31.5 in.

Length: 26 in.

Wing area: 288 sq. in.

Flying weight: 7.6 to 9.7 oz. (as tested, 8.3 oz.)

Wing loading: 4.2 oz./sq. ft.

Servos: GWS Pico

ESC: GWS ICS 100 5 amp

Battery: 150mAh 6-cell Ni-Cd

Hits

- Great flight performance.
- Easy to build.
- Low price.
- Vintage scale appeal.

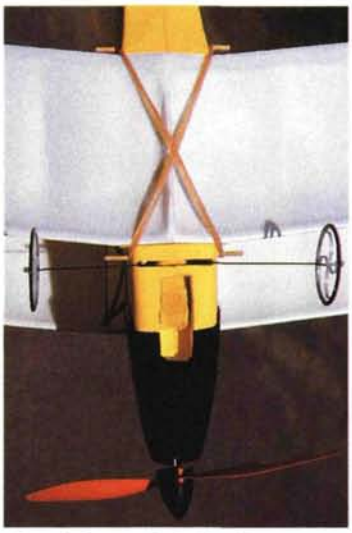
Misses

- Struts could be stronger.
- Landing gear is too flexible.

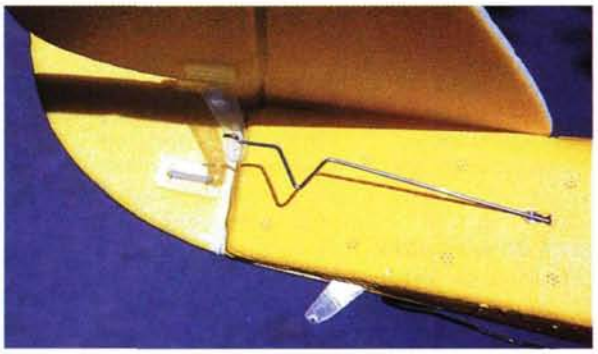
being under-powered, marginal flyers. This is not true of more recent releases in this market and is definitely not the case with the Tiger Moth. Though you should never expect anything approaching glow performance from any model in this class, the Moth does climb to altitude with authority, and with its gear-driven 9x7 prop, it has enough thrust to get you out of trouble if the need arises—and, sooner or later, you know it will. Using the 150mAh 6-cell Ni-Cd packs specifically designed for this model, I got 7 to 9 minutes of duration, depending on throttle use. With suitable NiMH cells, I'm sure 12- to 15-minute flights would be realized.

This little bipe can be maneuvered in small areas, doing high, banked tight turns, just as a biplane should, yet it has the rock-steady characteristics of a trainer and doesn't show any tendency at all to snap; in fact, you could teach a beginner with this one or, with the controls set up at maximum, you can create your own aerial circus in the confines of a baseball diamond.

This little bipe is so much fun that I could fly it until I had a serious case of numb thumbs. It's simply one of the best flying slow flyers I've come across to date.



Just in front of the landing-gear wire is the battery-holding box. It is specially sized for a 7.2V 150mAh Ni-Cd pack.



The tailskid is simply glued into a precut slot in the fuselage. Vee-bends are put in both the rudder and elevator pushrods for shock-absorbing purposes.

CONCLUSION

GWS has really hit upon a successful combination with its airframes and drive systems, and the Tiger Moth, in my opinion, is its best yet. It has tremendous vintage beauty in the air, it flies fantastically and—here's the best part I haven't told you about yet—sells for only $55! What else can I say but go get one for your backyard or next family camping trip.

Grand Wing Servo (GWS); *distributed by Balsa Products Engineering (www.balsapr.com); Global Hobby Distributors (www.globalhobby.com); Horizon Hobby Inc. (www.horizonhobby.com) and Maxx Products (www.maxxprod.com).*
GWS *Tiger Moth distributed exclusively by Horizon Hobby (www.horizonhobby.com).*

Largest Indoor RC Fun-Fly and Contest in U.S. History

by Tom Atwood

On May 18 and 19, in the heart of Texas, Model Airplane News, RC MicroFlight and the National Indoor Remote Control Aeromodeling Council (NIRAC) co-sponsored the largest indoor RC fun-fly and contest in U.S. history. Held at the Southwestern Aeromodeling Conference (SWAC), the AMA-sanctioned event featured more than 150 aircraft and 53 pilots, many of whom competed in seven classes. Flying began at 9 a.m. on both days, and thousands of attendees streamed off the main floor into the spacious flying area to witness the remarkable exhibition and competition.

Airplanes competed in aerobatics, pylon racing, limbo, scale and other flying categories, and for many who were there to witness the excitement, indoor RC took on a new meaning. Most of these ships could have flown in mild conditions in any park or backyard, and most had been flight-tested in exactly those places. The real story at this meet was the new plug-and-play equipment that gives this new breed of very small electric aircraft such astounding performance.

PYLON RACING

Among the most impressive competition aircraft were the indoor pylon racers. For the most part, they used stock GWS receivers, speed controls and motors (gearing and props differed with aircraft). These racers typically weighed 6 to 7 ounces and flew at speeds of 10 to 17mph—easily fast enough to penetrate light wind, had the event been held outdoors.

(Continued on page 88)

The scale, foam-construction Reno racers scratch-built by Jerry Small were among the fastest and the most amazing to watch. Racing rules limited batteries to 6-cell, 7.2V, 120mAh packs; Jerry used compact Ni-Cd batteries that looked just like the familiar 9V transistor-radio or fire-alarm batteries (down to the connectors). With a scratch-built 4:1 gearbox, his bright red Critical Mass pulled 2.5 to 3 amps in the 10-lap course, which took just over a minute to fly. [Editor's note: GWS sells similar racing motor configurations such as the S1 with a 4.14:1 geared motor and the S2 with a 3.5:1 ratio—see "Micro Scoop"].

Pilots on the flightline concentrate on team combat.

Gary Jones shows off his 12.8-ounce B-36 powered by six Wattage B-2 motors. Controlled by a Hitec 555 servo, the plane features programmed rudder/aileron mixing for coordinated turns. Powered by 6 350mAh cells, it sounds great and flies majestically.

Spinning props such as the GWS 8x6 and 7x6, Jerry's racers are optimized for approximately 2-minute flights. If you want to build a scale racer but prefer a milder setup for the local schoolyard, the standard 5.86:1 geared motor will work fine (you'll find it in any WattAge Lite Stik or GWS Pico Stick kit). If you scratch-build a racer using the standard gearbox, you should know that the pylon racers recommended the GWS 9x7 prop rather than the stock 10x4.7.

Jerry Small's Critical Mass is one of several scale, foam Reno Racers Jerry has scratch-built built for indoor pylon racing. The plane features a 4:1 scratch-built gearbox and a GWS motor spinning a 4-blade prop. It uses a pull-pull system and flies as if it's on rails.

DIVERSITY OF AIRCRAFT

The scale airplanes campaigned in static and flight competitions ranged from classic antiques to a six-engine B-36. The large variety of experimental aircraft included everything from ultra-slow-flying hang gliders to Pico Stick and Lite Stik "mods" with canard, biplane and tandem-wing setups. Team Combat was particularly interesting because the aircraft flew so slowly that you could visually track the one-on-one battles. Piloting expertise was at a premium in the Limbo competition, which Hubert Bitner won flying a modified Roswell rotorcraft (yes, he had to fly, not "hover," under the bar!). Chris Bowker was a close second in Limbo; he's a young pilot who has clearly mastered flying the Pico Stick class of airplane (winners had barely 1 foot of ground clearance). All registered pilots had ample time to fly; between competitive events, there was open fun-flying with up to four airplanes aloft simultaneously.

The editors of *Model Airplane News* and *RC MicroFlight* thank the NIRAC organizers for doing a great job of running this two-day event. Our thanks also go to Dr. Sandy Frank, AMA District 8 VP; he organized the second annual SWAC trade show and provided the spacious indoor flying site for this fun-fly and RC competition. Over 100 exhibitors and modeling-related organizations exhibited at SWAC, and the show was well worth attending, to say the least (if you are in the area next year, don't miss it!).

For many more photos and details on the airplanes that flew at the fun-fly and competition, see the July issue of RC MicroFlight (available on the Web at www.rcmicroflight.com).

Winners

	First	Second
Aerobatics	Dan Kreigh	Chris Bowker
	IFO	IFO
Helicopter	Hubert Bitner	Mike Flores
	Roswell Rotorcraft	Piccolo
Limbo	Hubert Bitner	Chris Bowker
	Roswell Rotorcraft	Pico Stick
Pylon—semi-scale	George Parks	Don Downing
	Corsair	Rare Bear
Pylon—stock	Lex Taylor	Gary Jones
	Pico Stick	Pico Stick
Scale	Ken Spencer	Steve Davis
	1909 Antoinette	1910 Valkyrie
Team Combat	Dan Kreigh	Gary Jones
	Chris Bowker	Ed Couch
	Lite Stik	Pico Stick

The Visionary who Created the GWS Product Line

Grand Wing Servo (GWS) founder, president and CEO Houng Lin made a special trip to SWAC to exhibit his company's products and present an analysis of trends in the hobby. Lin described his commitment to provide modelers with well-engineered RC airplanes and power systems that are affordable, safe and easy to fly. Given the growing popularity of GWS systems, his formula seems to be working.

GWS markets electronic components to the hobby as well as other industries (Lin is known as the "servoman" in the Satellite TV business) and has manufactured more than 30 million servos in the last two decades. It is no wonder that Lin's engineers have created low-cost systems that now enjoy a growing popularity with backyard and indoor pilots.

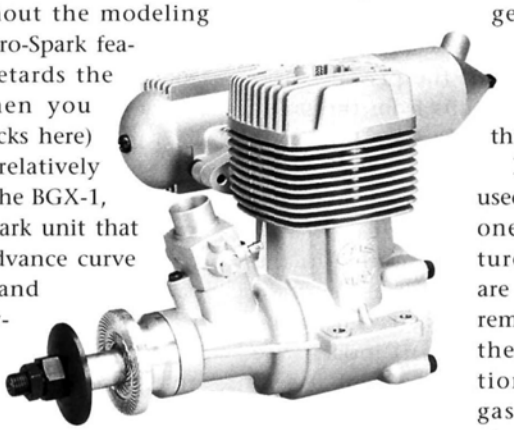
The GWS Tiger Moth is Lin's most recent airframe introduction, and additional exciting products are under development. These include an A-10 Warthog, an affordable, plug-and-play linear servo that is projected to weigh less than 4 grams, 3-blade props in various sizes and still smaller receiver, motor and battery combinations that will make a new generation of even tinier electrics possible.

GWS is also hard at work on servo mechanisms for non-hobby applications ranging from the automatic temperature control of shower water to CCD sensors that can be directed to look behind your motor vehicle. GWS has made major strides in the small electric arena and is a company to watch as the backyard flyer segment continues to expand.

Glow to gasoline conversion

Walt Wladyka of Shelton, CT, writes, "I would like to convert an O.S. BGX-1-3500 from glow to gas, primarily for economy of operation. Would you recommend this conversion?"

Walt, converting the BGX-1 to gasoline is a pretty straightforward procedure, provided you are prepared to invest in a spark-ignition system and, possibly, a new carburetor. One ignition unit that I'm familiar with is produced by CH Ignitions of Riverton, WY. This company markets a capacitive discharge ignition system with Syncro-Spark timing control, which is widely used throughout the modeling community. The Syncro-Spark feature automatically retards the ignition timing when you hand start (no kickbacks here) and during idle. For relatively large engines such as the BGX-1, CH offers a Syncro-Spark unit that completes its spark advance curve by about 4,000rpm, and this ensures that low-rpm torque and horsepower performance aren't compromised.



A second consideration involves the carburetor. Although the glow carburetor supplied by O.S. will function satisfactorily on gasoline, there are advantages to using an aftermarket unit that both pumps and regulates fuel to the engine. Walbro, a Japanese company, is one of several manufacturers that provides diaphragm-type carburetors intended for small engines that power weed-whackers, chain saws, leaf blowers and other equipment. Over the years, these carburetors have been successfully adapted to many miniature aircraft engines such as the BGX-1.

Fuel-tank positioning (vertical and horizontal) within the airframe is critical for proper engine operation with the O.S.-supplied throttle-barrel carburetor that uses muffler pressure. With a Walbro-equipped engine, the tank can be placed anywhere within the model without affecting the air/fuel mixture. This means that you can place the tank at the model's balance point, if you wish. The standard O.S. carburetor can be made to work more reliably by adding a Cline regulator, which has a diaphragm-type pressure regulator and is driven by timed engine crankcase pressure to pressurize the fuel tank. CH offers a gasoline conversion kit for the BGX-1; it includes a Walbro carb, a carb adapter, bolts, a gasket, an O-ring and a pressure fitting.

You can't run lean gas/oil mixtures (50:1, for example) with this engine because it isn't fitted with needle-bearing-type connecting-rod bearings. Its plain-bearing bushings require about 10 percent lubricating oil in the fuel (9:1). CH suggests using Klotz KL-100 (half synthetic and half castor oil) for this application.

If you have never used gasoline fuel in one of your miniature engines, there are several things to remember. Safety is the first consideration. When using gasoline fuel, I always carry a fire extinguisher to the flightline because the chance of fire is much greater than with glow fuel. Transporting gasoline in an approved container vented to the outside of your vehicle is another important safety and health consideration.

Relative to glow fuels, gasoline engines run at higher temperatures, so it's important to provide good ducting through engine cowls—especially to the cylinder and head fins. Don't worry about cooling the crankcase; it operates at a reduced temperature because of the fuel vaporization (a physical change during which heat is absorbed) happening there. Although gasoline removes less heat than methanol-dominated glow fuel, it's still enough to keep the crankcase cool without external airflow considerations.

As always, avoid setting the needle valve right at its peak rpm; instead, back it off a few hundred rpm (rich). You won't notice an appreciable reduction in performance, and besides, you can't afford a damaging hot, lean run. Remember that gasoline doesn't have the power potential of glow fuel, so the engine will produce a few hundred less rpm on any propeller size.

Requiring only about half the tank size for an equivalent run time—depending on how rich or lean you set the needle valve—the gasoline mix is much less expensive (even at $1.75 per gallon) than glow fuel, and it promises improved idle and throttling with less oil residue deposited on your model. Are the benefits worth the additional costs and concerns? Many believe they are.

TIGHT ABC PISTON

Hal deBolt of Sun City, FL, writes, "A while back, K&B sent me one of its new .48s ... a pretty engine. I attempted to use it, but it was so tight I couldn't get it to turn over—no way! So, I set it aside.

"Recently, I needed an engine, so I loosened the K&B piston by hand lapping it to the cylinder; now it starts normally and runs fine.

"Anyhow, I wondered if you have had a chance to play with this one? From what I see, it seems to be very, very potent. For my flying, I used a 12x8 Master Airscrew that tached 11,500rpm (like most .60s). I have it in a Jenny which would tear up most pylon courses—too fast for me these days!"

Author's note: with more than 60 years of experience working with miniature aircraft engines, Hal "Pappy" deBolt has done it all, from control-line speed to RC Pattern to pylon racing. He certainly doesn't need advice from me concerning the K&B engine and its operation! Living in western New York all of my life afforded me the opportunity to become his friend, work at his factory (Demeco Models) during college summer vacations and fly against him in competition. Our many conversations at his shop, home, contests and conferences were always inspiring. Hal always looked for ways to improve the hobby—which he did with his many designs, innovations and products. He's doing the same today—at the age of 82—with autogyro experiments.

The following is intended for RPM readers and the amusement of "Pappy."

Hi, Hal! Yes, I've experienced the same problem with the K&B .48 and many other ABC-type engines over the years. ABC-type piston and cylinders include: ABC (aluminum piston with chrome-plated brass cylinder), AAC (aluminum piston with chrome-plated aluminum cylinder) and ABN (aluminum piston with nickel-plated brass cylinder). These are designed to have a slight interference fit near top dead center; this disappears after the engine heats up because the brass and aluminum cylinders expand faster than the high-silicon-content piston.

As you know, these lapped (ringless) piston engines will leak compression and combustion gasses if the piston is too loose. It's advantageous from the point of peak performance to keep this tight cold fit.

Although your method of loosening the piston worked, there's a much easier way to accomplish the same results. In the future, use a heat gun to warm the cylinder before the first few starts during the break-in period; this will loosen the assembly and permit you to crank it over without breaking the crank pin, connecting rod, or piston. An additional benefit: only the top portion of the piston will wear to the tapered cylinder, thereby ensuring the best possible fit.

Because ABC-type engines were originally designed as wide-open-throttle racing engines, they operated at close to their design temperature for most of their useful lives. Today, these engines are expected to both idle and throttle reliably. Unfortunately, this permits them to cool excessively, which causes the piston to rub away the critical fit near top dead center.

Although there isn't much we can do about the cooling-related wear that the engine experiences during idling and throttling, a few tricks can extend its life:

• From the beginning, use the highest factory-recommended nitromethane fuel content with a new ABC-type engine. If the instructions say to use 5 to 15 percent nitro, then use the higher 15 percent. This generates the highest combustion temperatures and, therefore, the greatest clearances between the piston and cylinder, when they are the tightest they'll ever be. After running the engine for a season or two, you will probably notice that performance begins to diminish. Performance can be determined by comparing tachometer readings on a standard propeller from when the engine was new to the time of comparison. If rpm drop by several hundred or more, the piston-cylinder clearance is probably excessive ... so you should reduce the nitro content to 5 percent. Less nitro means lower combustion temperatures and less component expansion, and this results in a tighter piston-cylinder fit with less blowby and lost power. Experience has shown that reduced nitromethane content is compensated for by the improved piston-to-cylinder fit at running temperatures. That's why some "worn-out" sport pylon racing engines make very acceptable fun-flying engines—less nitro!

• Never run an ABC-type engine 4-cycling rich. From the first time the engine is started to the end of its useful life, the relatively cool temperatures generated by firing every other revolution of the crankshaft accelerate piston wear and the onset of reduced performance.

If you have an engine question you'd like to see answered in this column, you can email me c/o the magazine at man@airage.com or write to me c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

C.H. Ignitions, P.O. Box 1732, Riverton, WY 82501; (307) 857-6897; fax (307) 857-6900; www.ch-ignitions.com.

Cline and Associates, 807 Alpha Rd., P.O. Box 44, Alpha, OH 45301; (937) 426-4167; fax (937) 426-7711; www.billsroom.com/pcfs.

K&B Model Products Inc., P.O. Box 98, Sierra Madre, CA 91025; (626) 359-9527; fax (626) 301-0298; www.modelengine.com.

Klotz Special Formula Products Inc., 7424 Freedom Way, Fort Wayne, IN 46817; (800) 242-0489; fax (219) 490-0490; www.klotzlube.com.

PLANES WORTH MODELING

3-View Documentation for Scale Modelers

by Dick van Mourik

Z-137 Agro Turbo

In November 1960, two of Czechoslovakia's major aircraft manufacturers, Moravan and LET, joined to design and build the Z-37 Agro—an aircraft intended for crop-dusting, water bombing and glider towing. Moravan produced the fuselage and some of the auxiliary parts, and LET produced the wings and assembled the aircraft. The prototype was equipped with a Russian, air-cooled, 9-cylinder radial engine that provided 260hp, and the Z-37 first flew on June 29,1963.

By 1984, six more prototypes and a total of 723 aircraft had been produced, all equipped with geared Russian engines. These variants are known as Z-37, Z-37A and Z-37-2 (trainer-version) Cmelák, or Bumblebee.

Because of a shortage of the original engine, some aircraft were tested with the Czechoslovakian 700hp Walter M 601 turbine engine driving a 3-blade prop. Fifty-two aircraft in this configuration, known as the Z-137, were developed before production ended in 1994. The Walter-powered Z-137 was officially designated the Agro Turbo.

The Z-137 can operate from rough grass airstrips, and even in far from perfect conditions, it is able to withstand the fatigue of everyday use; this seems to be typical for nearly every Eastern European aircraft design.

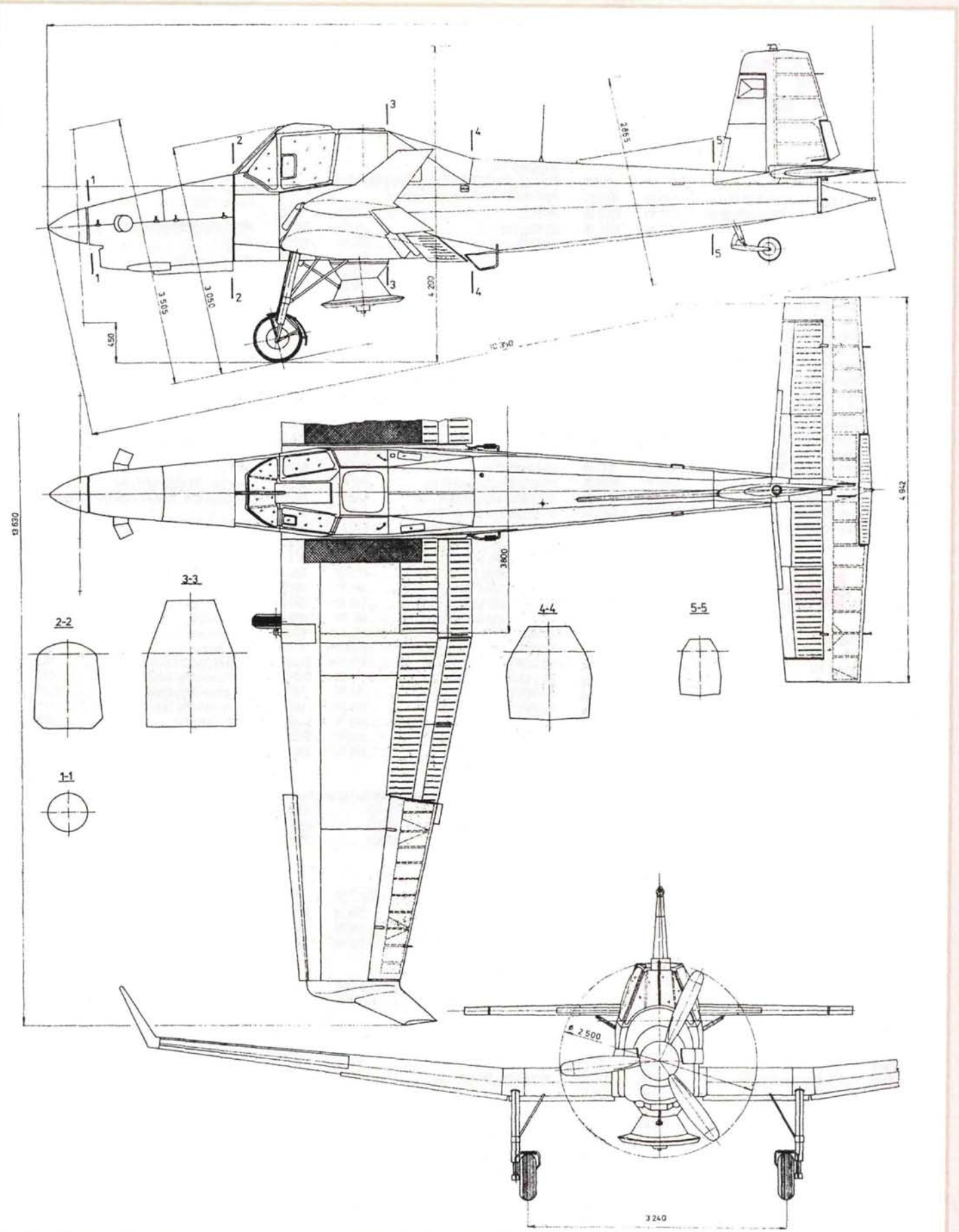
Because crop-dusters are often flown at low altitudes, the Agro Turbo has a large greenhouse canopy that provides exceptional visibility for its single pilot.

It is most impressive to watch a Z-137 in flight; the aircraft appears as if it might stall at any moment, but it easily copes with any critical situation. When flaps and slats are deployed, the aircraft slows to what looks almost like walking speed.

SPECIFICATIONS

Name: Z-137 Agro Turbo
Manufacturer: Moravan/LET
Wingspan: 44.71 ft.
Length: 34.32 ft.
Height: 11.52 ft.

PERFORMANCE, WEIGHT AND LOADING
Empty weight: 2,756 lb.
Max. payload: 1,984 lb.
Max. level speed @ 1,600 ft.: 136mph
Cruising speed @ 1,600 ft.: 119mph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Make your own fiberglass parts

A quick, easy and inexpensive method

by Dan Santich

Dan Santich shows off his impressively large Miss San Bernardino. Dan shares his easy method for making those all-important fiberglass parts.

Making fiberglass parts for our model airplanes is often considered a difficult task. Several companies produce engine cowls and wheel pants for popular designs, but if you scratch-build a new airplane, you'll have to make your own custom parts.

I have offered many aircraft designs that required additional fiberglass parts, but I never had to tell builders how to make them because commercial parts were often available. Let's face it; it is a lot easier to simply order a molded part than to produce one from scratch. Or is it?

My ½-scale Miss San Bernardino (see page 76), can be built by the average modeler, and all its fiberglass parts (the engine cowl, cowl cheeks and wheel pants) were fabricated using this simple method. This technique can be applied to virtually any project for which a custom-made fiberglass part is needed.

Here is what you will need:

- Blue insulation foam.
- Fiberglass resin (epoxy or polyester).
- Fiberglass cloth.
- Fiberglass mat.
- Mixing cups.
- Inexpensive 2-inch paintbrush.
- Mixing sticks.
- Acrylic automotive touch-up putty.

The materials you need are inexpensive and readily available. Here, Marson-brand polyester resin is being used. The bare blue-foam plug is shown at the right.

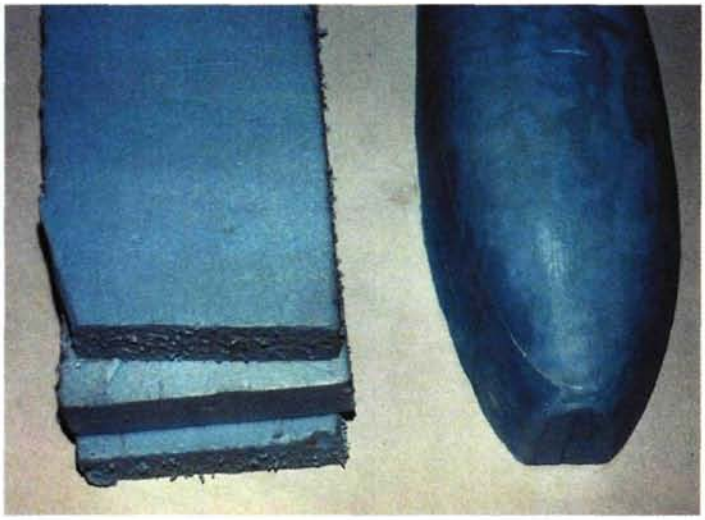
FIBERGLASS AND RESINS

Several sizes of fiberglass cloth are available; it is identified by its weight per square yard (9 square feet). The size of the part you want to make and how durable it needs to be are what determines the cloth's weight. For general model applications, ½- to ¾-ounce cloth is appropriate. Fiberglass mat comes in sheets; it can be used as is, or it can be shredded before use to produce a lighter structure.

Available at hobby shops, most marine-supply outlets and at some automobile-parts stores, fiberglass resin is available in various grades depending on its use. It is best to use a resin that has the viscosity of motor oil. I use Marson-brand resin because it has a thick viscosity, is semi-flexible when it has cured, and it sands easily and sets up quickly. Because it is thick, it won't penetrate into the wood as much as thinner resins do, and that means you'll get a lighter finish over a balsa structure. A lot of commercial companies use epoxy resin, but I like to use polyester resin because it sets up much faster—usually in about 5 minutes. You can vary the setup time by adding more or less catalyst (usually 10 to 12 drops for each ounce of resin). When using polyester resin, be sure the air temperature is above 60 degrees F, or it will take a significantly longer time to cure.

THE PLUG

I use blue household-insulation foam to make the plug for the part I want to mold. Blue foam is cheap, and it is much denser than white expanded-bead foam. Blue foam can easily be glued together and is easy to work with. It can be carved with a sharp knife and sanded almost like balsa. It can be purchased at most home-improvement outlets and comes in large 4x8-foot sheets.



Make the plug by laminating several layers of the insulation foam into a block of an appropriate size. Cut, carve and sand the foam to shape.

When you determine the size of your part, cut the foam to approximately that size. Slice the foam into layers and laminate them together into a block of the required thickness. I use foam-safe ZAP to laminate the foam, but epoxy or white glue works, too. Draw the part's top outline on the top of the foam block and cut it to shape; then draw and cut the side view and whittle and sand the foam to its final form. When you have a foam plug that looks like the part you want, cover it with iron-on Econokote or another plastic film that has low-temperature qualities so you won't melt the foam with your sealing iron. Once the plug is covered, you can apply a coat of mold release. This isn't necessary, however, if you let the resin cure long enough.

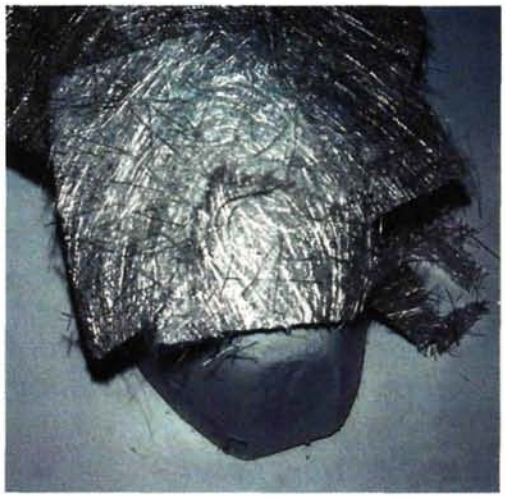
To protect the foam, and to make it easier to remove the molded fiberglass part, cover the finished plug with low-temperature Econokote (or similar) covering film.

Apply the thick fiberglass mat first. Smooth it around the plug and apply your resin. Using a brush, start at the highest point and work the resin downward. Then add the fiberglass cloth, and when you have the foam form completely covered, use the mixing stick to squeegee out the excess resin, again starting from the highest point and working downward. (Old plastic credit cards make good squeegees.) Remove as much resin as you possibly can. After the first resin coat has hardened, apply a second coat and let everything set up overnight.

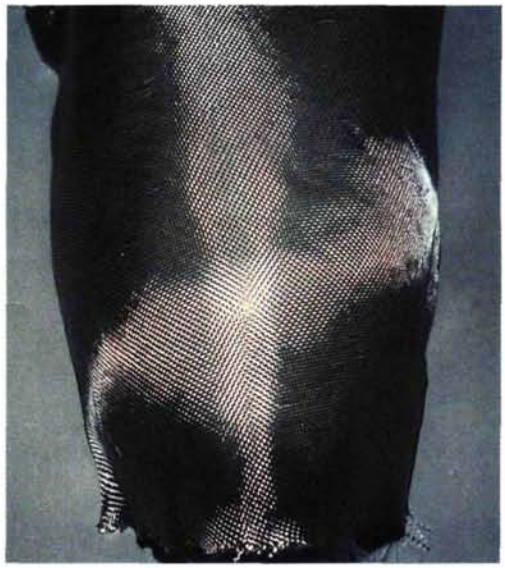
The next day, remove the molded part from the plug. Sand the part smooth and fill any imperfections and pinholes with acrylic automotive touch-up putty. Sand it smooth again, wipe it down with a tack cloth, spray on a coat of sandable primer, and you are ready to paint on your final color.

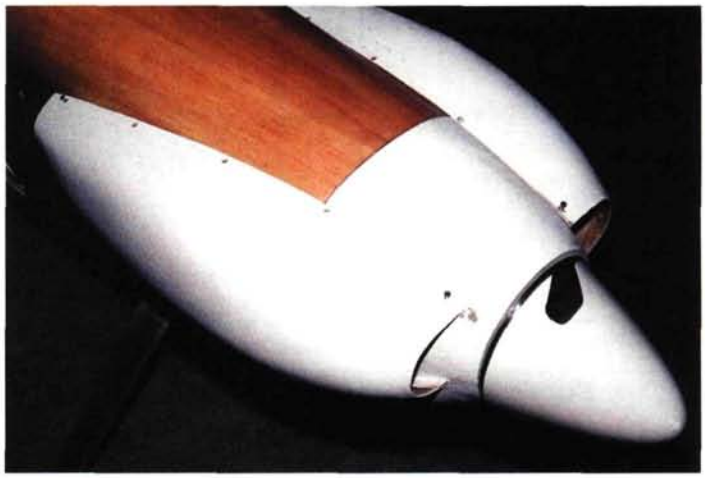
Custom making parts is very easy to do once you learn this technique. A whole new selection of modeling subjects will open up to you when you know how to make molded fiberglass parts.

Start by applying the mat fiberglass material to the plug. Coat it with resin by starting from the highest point and working it downward.



Once the fiberglass mat is saturated and formed tightly around the plug, apply the fiberglass cloth over it and then apply more resin. Fully saturate the cloth and then remove as much excess resin as possible. When everything looks nice and smooth, let the part set up over night.





After a little bit of sanding, filling and priming, the custom-molded fiberglass parts are attached to the model and are ready to be painted.

by George Leu

Improve your scale piloting skills

I have devoted several columns to improving your static score in scale competition. This score represents 50 percent of your total, and taking the time to improve your documentation material between events can help maximize your overall score. This time, I'll talk about improving your flight scores and how to help both the pilot and the flight judges.

Left: it's pretty difficult to fly at a new location and while under the pressure of competition. A good way to ease the pressure is to have a caller who knows your flight routine and who can help you communicate with the flight judges. Above: important information about flying is available at every scale meet at the early-morning pilots' meeting. Listen and ask questions; your flight score will benefit.

FLYING SCALE

When you fly your model at an event, you will be faced with variable conditions, including:

• **Wind direction.** Wind has the biggest effect on models because it can change quickly during the day. It affects takeoff direction and the headings of the maneuvers flown. Plus, it is usually calmer in early morning and windier during midday.

• **Position of the sun.** The sun's position often requires you to move your maneuver to the right or left of the flight judges; this is done for safety and is OK with them. But moving your maneuver can throw you off pace a bit and make you feel uncomfortable.

• **Flightline position.** If you have to come in over a tree line to land, you may tend to fly the approach higher than normal. If your flight station is also close to the trees, your landings may be slightly past the judges' centerline. Don't expect perfect flightline placement.

With the help of Dave Fogarty (far right), Dave Platt (far left) demonstrates the scale features of his impressive Mohawk at the 1995 Top Gun scale event. This is also when Dave would explain his flight maneuvers to the flight judges.

• **Field conditions.** The runway can be grass or paved; either surface will greatly affect your model's ground handling. The length of your takeoff will also be affected by the grass's length, while paved surfaces are a nightmare for airplanes with non-steerable tailskids.

• **Time of day.** It might sound silly, but the time of day also has an effect on your flying. Early-morning flights are affected by the dew on the grass; it makes landings slippery. In the afternoon, heat rising off the pavement can cause turbulence. As the day goes on, crosswinds can replace calm conditions.

PRACTICE

To improve your ability to deal with changing conditions, you have to practice. If your club's field has a grass runway, practice flying from it both when the grass is newly mown and when it's overdue for a trim. Fly early in the morning and late in the afternoon; practice landings and takeoffs from both the left and the right. Fly on windy days, and when it's calm. Experience will help you become a better competitor, and being prepared for change often means the difference between an average flight score and a good one.

AVOIDING CONFUSION

Preparation is a good thing for contestants, but I think it's equally good for judges. They should be prepared to make allowances for field conditions, weather and unforeseen events. Most important, everyone needs to understand what the various flight maneuvers are supposed to look like and how they should be performed. I think it will be to everyone's benefit if all participants (judges and pilots) refer to the AMA rules in the 1999-2001 Competition Regulations booklet.

These guidelines separate maneuvers into three categories that are judged: Precision, Presentation and Realism. For the sake of consistency, give each category some thought (whether flying or judging them). Let's take a closer look at these important areas to be judged.

• **Precision.** A contestant should always talk to the judges before beginning to fly and explain what each maneuver will consist of so the judges can form a mental image of the maneuver. Whatever you say you'll be doing is what the judges will look for, so be certain to do what you said you would do! If you say that your Ju-87 Stuka dive-bomber will perform a 90-degree bombing dive before it releases its bomb, don't dive the model at a 75-degree angle.

Judging begins when the contestant announces "Beginning now!", and it continues until he calls, "Maneuver complete!" After announcing the beginning of the maneuver, fly a straight course for about 50 feet before actually performing

Left: slower-moving aircraft, such as this Sopwith Pup flown by Kim Foster, should be flown a little closer to the flightline. Above: ducted-fan-powered jet models travel at very high speeds, and thus, will require a larger evaluation box to judge flight maneuvers. It's also a good idea to fly fast models a little farther away from the flightline.

the maneuver. Do this at the end, as well; fly 50 feet along a straight path before calling the maneuver complete.

If done in a smooth, prototypical manner, course corrections are downgraded, but not severely. Most maneuvers should start and finish at the same altitude (exceptions to this are the split-S, 360-degree descending turn, 3-turn spin and the Immelmann turn). Keep your wings level, and don't make abrupt altitude or heading changes during your maneuver. To maximize your precision score, you want to perform centered and balanced maneuvers.

You can't give the flight judges too much information before your flight. Don't just say you're going to execute a roll—be specific! Will it be a barrel roll or an axial roll? What should the judges look for? If you tell them, your score will be higher.

• **Presentation.** I love this part because it is so basic. For a maximum score, present your maneuvers so they can be judged easily. The best place to perform a maneuver so the judges have the best view of it depends on which maneuver you're performing. For a clear view, a stall turn or a wingover should be offset to the left or right of the judges. Maneuvers that have horizontal symmetry, such as loops and cobra rolls, should be positioned with their midpoints centered in front of the judges. It is also important to fly above the runway's centerline or at the proper distance from the judges, as stated by the contest director (CD). This is an important safety issue, so pay attention at the pilots' meeting.

If you move your maneuver to the left or the right of the judges because of the sun's position, be sure to explain what you are doing. If you fly through the sun, you can receive a severe downgrade.

Your presentation will also be affected by the aircraft you fly. A fast-moving jet or WW II fighter is best presented at a bit of a distance from the judges. Slower WW I or civilian aircraft benefit from being flown closer.

• **Realism.** It is difficult to explain how realism is scored because it is so subjective. To maximize your score, fly only those maneuvers that your aircraft was capable of doing in full scale. Hotshot pilots who perform three axial rolls with a model B-29 should expect a downgrade. For better realism, stick with prototypical maneuvers. The size of the maneuver should also reflect the aircraft's capabilities. A jet could make very large loops at high speed, but performing small, tight loops would result in a downgrade because in the full-size plane, the pilot would have been subjected to high-G forces. A J-3 Piper Cub would be capable of making loops, but because of the Cub's limited power, the loops would have to be somewhat small in diameter and more oval than perfectly round. A pilot who performed high-speed loops with this type of plane would be significantly downgraded. Aircraft size may also affect a pilot's Realism score. A ¼-scale Sopwith Pup is expected to perform larger maneuvers than a ⅙-scale Pup. It is very important to account for the scale size and speed of your plane.

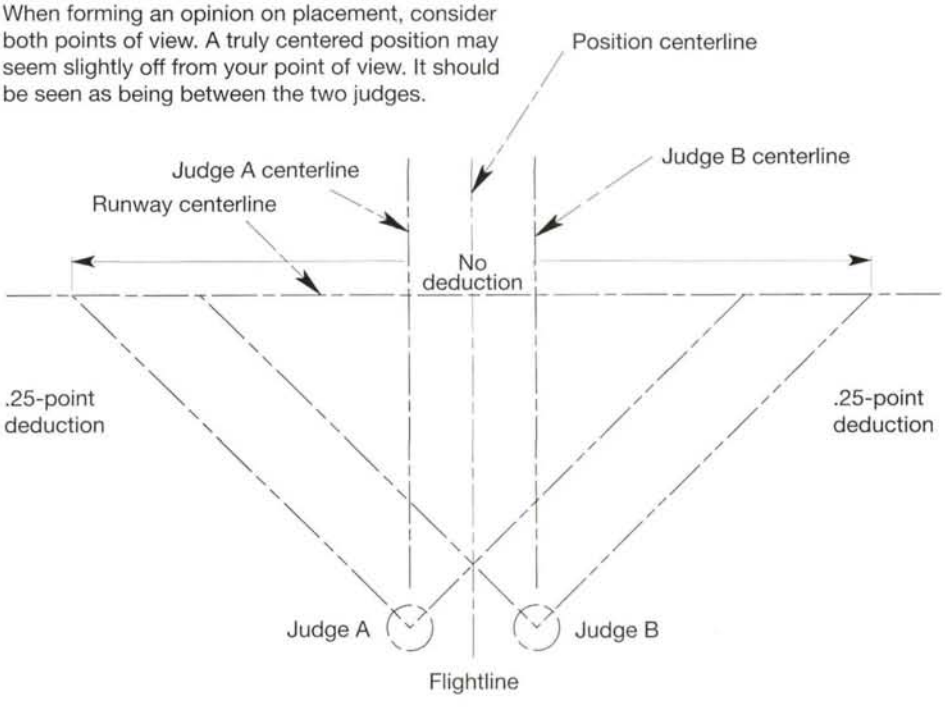
Smooth, graceful flight presentations have a great impact on realism. Judges often pretend to be passengers in the aircraft they are judging. Jerky, bumpy flying is unrealistic and will hurt your flight score. Abrupt takeoffs and landings also cause downgrades.

COMPILATION

Placement, Presentation and Realism make up equal parts of the flight-scoring process. At some events, Realism is treated as a separate flight maneuver worth 10 points, but remember: it is evaluated during and

Figure 1. Judges' view

Each judges' point of view is slightly different. When forming an opinion on placement, consider both points of view. A truly centered position may seem slightly off from your point of view. It should be seen as being between the two judges.



between each maneuver you fly. These 10 points are more of an overall grade of how realistically you performed with your aircraft.

In general, flight judging is more difficult than static judging because it relates to how we *think* the prototype aircraft flew. When your model is static-judged, it is compared to your documentation booklet and your 3-view drawing. If you talk to the flight judges beforehand and tell them what your maneuvers will look like, it will help them to score you more consistently.

Are there other factors that affect flight scores? Yes; the basics—being polite, being organized and being ready to fly when you're called to the ready box—will undoubtedly help. Improving your flight score is an ongoing process.

Figure 2. Positioning for judges

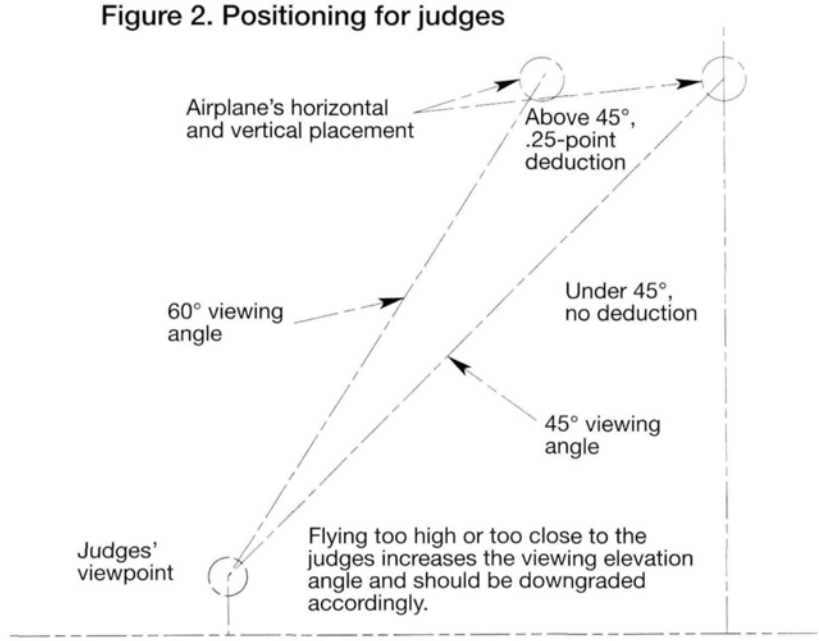
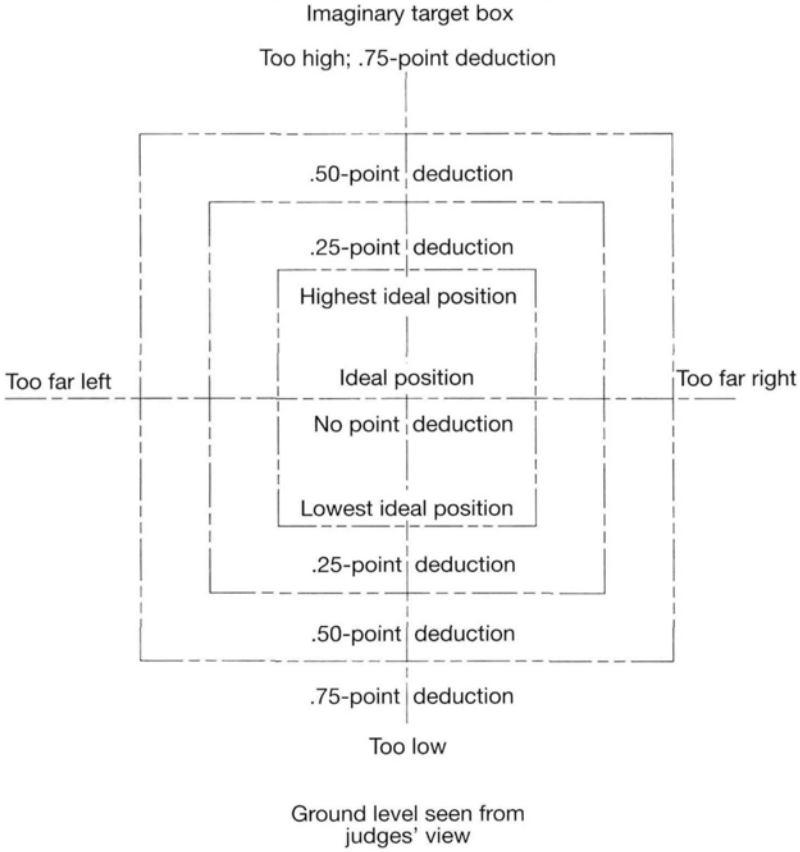


Figure 3. Placement target



THE JUDGES' POINT OF VIEW

Let's face it, it isn't easy to fly in competition. The AMA rulebook covers scoring downgrades quite specifically, but when it comes to Presentation, I feel that the judges should focus on maneuver position using three references: looking upward, looking to the sides and looking straight ahead. I prefer to work with ¼-point deductions because they are fairer to pilots who fly many different types of airplanes.

Figure 1 shows how two judges sitting together can have varying perspectives when viewing a maneuver that's being performed right in front of them. Each judge should be aware that a maneuver that appears to be to his right or left may actually be placed correctly in the center. I don't think this "middle ground" should have any downgrades applied for placement, and each outer area should use an ascending ¼-point deduction.

Figure 2 shows a side view that uses a 45-degree angle to establish its upper boundary. Downgrades are given for flying above it or for flying too close to the judges. Again, there are no downgrades for flying below the 45-degree angle. If a pilot performs a stall turn, a spin, or a specific high maneuver, and the highest part of his maneuver is above the 45-degree angle, his score is not downgraded.

Figure 3 shows what the judges see when they look straight at the flying field from their seats. Each maneuver requires its own interpretation for the "ideal flying zone," but once that has been done, all downgrades should follow the same standard. By using ¼-point downgrades, a judge can determine if the maneuver is positioned too far off center, too high, too low, too far away from the flightline, or if it is too large. If we keep in mind that the pilot must still perform his maneuver with regard to perfection and realism, I think the ¼-point deduction system is a fair way to score. I'd love to hear what readers have to say. Whether you are a contestant or a judge, please let me know what you think by writing to "Scale Techniques," c/o *Model Airplane News*, 100 E. Ridge, Ridgefield, CT 06877-4606 USA; man@airage.com.

NAME THAT PLANE

Can you identify this aircraft?

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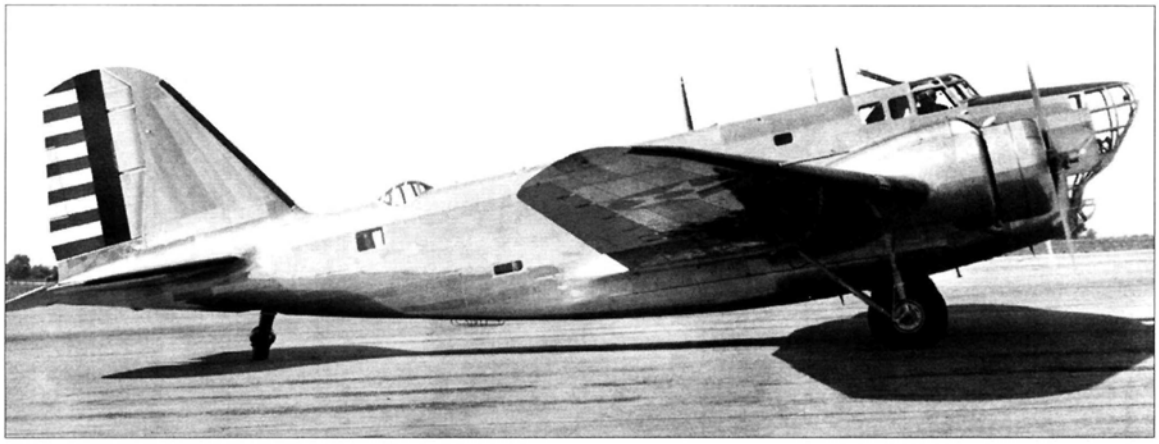

Craig Seay of Port St. Joe, FL, correctly identified the July 2001 mystery plane as a Consolidated Vultee XA-41. It was initially intended to serve as a dive-bomber, but its role was later amended to low-level ground attack.

Because orders for combat aircraft were greatly reduced late in WW II, production of the XA-41 was canceled, and the aircraft served primarily as a test bed for the large 3,000hp Pratt & Whitney radial engine. With a wingspan of 54 feet and a length of 48 feet, 8 inches, the XA-41 had a maximum speed of 363mph. Four 37mm cannon and four .50 caliber machine guns were installed in the wing, and it could carry a bomb load of 6,400 pounds.

The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

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EVENTS

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BY FRANK GUDAITIS

Miniature 4-stroke gas radial

George Luhrs' amazing miniature engines have graced the pages of *Model Airplane News* before. This micro masterpiece is his latest—and perhaps greatest—achievement: a 5-cylinder radial displacing just 0.061 cubic inches. Just 2½ inches in diameter, it is the world's smallest 4-stroke gas-ignition radial aircraft engine, and it is not a model of a full-size engine. Instead, George designed, machined and assembled it from scratch in his Shoreham, NY, shop. He fabricated every one of the 244 parts, plus laminated 33 parts to form the 5-inch-diameter, 3-blade propeller. Each cylinder bore is just ¼ inch with an equal-length stroke, which yields a displacement of 0.0122 cubic inches for each of the five cylinders.

The cylinder heads, crankcase, rocker arms and the fuel-tank cover are all wrought from 7075-T7 aluminum. The cylinders, pistons, connecting rods, crankshaft, cams, followers, wristpins, master rod and pins and all bearings are made of hardened tool steel. The pushrods are 0.018-inch-diameter spring steel. The valves and the prop hub are stainless steel. The valve guides are made of copper bronze, and the valve springs are 0.006-inch-diameter spring steel wire.

The carburetor is made of brass and has a choke and a throttle. Fuel is fed into a manifold on the rear of the crankcase, then brass induction tubes supply the mixture (lantern fuel with 10 percent WD40 lubricant) to the intake ports. The distributor cap is made of Delrin, the rotor is Teflon, and the points are 0.046-inch-diameter tungsten; the unit is adjustable with a timing lever. The spark plugs are stainless steel with Macor insulators. George initially used plugs from one of his previous engine designs, but these have not operated reliably in the radial, so he is fabricating new ones.

At present, George has two workable prototypes of his engine. The primary difference is in the cylinder sleeve material; the second engine uses hardened tool steel for both the piston and the sleeve, whereas the first used it only for the piston. The black sleeves on the engine on the right in the photo reveal it to be the second prototype.

In April of 2001, this extraordinary little engine was awarded first prize at the National Model Engineers Exposition held in Detroit, MI. This is the second year in a row George has taken that honor; last year, he won for his miniature in-line 4-cylinder engine (September 2000 *Model Airplane News*). This contest is judged by the public; obviously the folks in the Motor City recognize a work of engineering art when they see it.

SPECIFICATIONS

Type: 5-cylinder, 4-stroke, gas-ignition

Diameter: 2½ in. (from top of rocker arm)

Depth: 1⅞ in. (from prop face to back of distributor)

Piston bore: ¼ in.

Stroke: ¼ in.

Displacement: 0.061ci

Fuel: white gas (lantern gas) with 10 percent WD40